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# Assessment of the Status of Div. 4X/5Y Haddock in 2002

# Évaluation de l'état du stock d'aiglefin des divisions 4X5Y en 2002

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**Abstract**

The quota for 4X/5Y haddock has remained at 8,100t for the last 5 years and reported landings have been close to the quota each year. Abundance has been increasing since the early 1990s and is presently high. Production has been decreasing since the late 1970s and is presently low. Size-at-age, growth rate and fish condition are all at or near the lowest observed. Exploitation rate for ages 5-7 decreased from approximately 50% in the early 1980s but dropped below 20% (which corresponds to the currently used $F_{0.1}$=0.25) in 1994 to the present. Partial recruitment has changed in recent years and fully recruited ages have changed from 5-7 to 8-10. Exploitation on fully recruited ages in the 2002 fishing year will be below $F_{0.1}$ if the TAC is not exceeded. The 1998 yearclass is estimated to be the largest observed in the time series, and the 1999 yearclass is estimated to be very strong. These yearclasses may be overestimated by a factor of 2, due to the retrospective pattern. Spawning stock biomass (ages 4+) is estimated to increase to a high in 2003 and then decrease unless further strong recruitment occurs. Projected yield at $F_{0.1}$ in the 2003 fishing year ranges from 9,000-15,000t depending upon the weights-at-age used to calculate yields. Emphasis should be on how the potential yield from the current good recruitment should be utilized over time, and on the implications of that decision for 4X cod conservation as a result of the mixed fishery problem.

**Résumé**

Le quota d'aiglefin de 4X5Y est demeuré inchangé à 8 100 t pour les cinq dernières années et les débarquements déclarés se rapprochaient du quota chaque année. L'abondance, à la hausse depuis le début des années 1990, est présentement élevée, mais la production, à la baisse depuis la fin des années 1970, est faible en ce moment. La taille selon l'âge, le taux de croissance et la condition du poisson se situent tous à, ou près des plus faibles niveaux observés. Le taux d'exploitation des âges 5 à 7, qui se situait à environ 50 % au début des années 1980, est tombé à moins de 20 % (ce qui correspond au $F_{0.1}$ = 0,25 utilisé en ce moment) en 1994, niveau où il se situe maintenant. Le taux de recrutement partiel a changé dans les dernières années, les âges pleinement recrutés ayant passé de 5 à 7 ans à 8 à 10 ans. Le taux d'exploitation des âges pleinement recrutés pendant la saison de pêche 2002 sera inférieur à $F_{0.1}$ si le TAC n'est pas dépassé. Selon les estimations, la classe d'âge de 1998 sera la plus abondante de la série temporelle et celle de 1999 sera très abondante. Il se peut que ces classes d'âge soient surestimées par un facteur de 2, à cause du profil rétrospectif. La biomasse du stock reproducteur (âges 4+) devrait atteindre un pic en 2003, pour ensuite diminuer, à moins d'un recrutement en force. Le rendement prévu de la pêche à $F_{0.1}$ en 2003 varie entre 9 000 t et 15 000 t, selon le poids à l'âge utilisé pour calculer le rendement. L'accent devrait être mis sur la manière d'utiliser au fil du temps le rendement potentiel provenant du bon recrutement actuel ainsi que sur les répercussions de cette décision pour la conservation de la morue de 4X à la lumière du problème de la pêche mixte.

## Introduction

This document contains an evaluation of the haddock stock on the Southern Scotian Shelf and Bay of Fundy (NAFO Division 4X). As in previous assessments of this stock (Hurley et al. 1998, 1999), haddock caught by Canadian fishermen in NAFO Division 5Y are included in the management unit. Haddock in the Bay of Fundy area grow faster than haddock on the southern Scotian Shelf. As a result, haddock landings from 4Xmnop and 4Xqrs/5Y are handled separately and separate age/length keys are used for the two areas, designated as Scotian Shelf and Bay of Fundy stock components respectively (Figure 1). Similarly haddock catches from the research vessel survey strata 470-481 and 482-495 are handled separately, as Scotian Shelf and Bay of Fundy components (Figure 2). In 1999, the fishing year was changed from January to December to April to March. The TAC of 8,100t established for the 12-month fishery in 1999 was extended to 9,800t for the 15-month period ending March 31, 2000, based on the proportion of landings in the first quarter of the year over the last 10 years. The fishing year since then has been April 1 to March 31. The TAC has remained at 8,100t for the 2000/01, 2001/02 and 2002/03 fishing years.

The last full assessment of this stock was conducted in 1999 (Hurley et al. 1999) with annual updates in 2000 and 2001 (DFO 2000,2001). This assessment includes the research vessel survey data in the current year 2002, together with commercial landings data for the first half of the year and commercial samples of those landings, to determine stock status in the current year and to make yield projections for the fishing year 2003/4. The results of an industry survey conducted in 1996-2002 were also used in the assessment.

## Description of the Fishery

The long-term (1948-2001) reported annual landings of haddock in NAFO Division 4X/5Y average about 18,000t. Landings exceeded 30,000t during the mid- to late 1960s and again during the early 1980s (Table 1 and 2, Figure 3). Landings declined subsequently and have been below the long-term average since 1984. Landings reached 6,800t in 1989 when it was recommended that the fishery be maintained at the lowest possible level and the mobile gear fishery was closed in mid-season. Landings increased from 1989 to 10,530t in 1992 under a Management Plan that called for a by-catch fishery only. A TAC of 6,000t was implemented in 1993 and landings in that year were 6,968t. Landings in 1994 were 4,406t, the lowest level observed in recent history, under a quota of 4,500t and stringent fishing plans. The TAC in 1998 was 8,100t and total reported landings were 7,843t (Table 2). The 1999 TAC was set at 8,100t and was subsequently changed to 9,800t for a 15 month period ending March 31, 2000, based on proration from the average first quarter landings over the last decade. This 15-month quota was necessary to change the fishing year to an April 1 starting date. The TAC has remained at 8,100t for the last 3 years and reported landings have been close to the TAC.

The fishery was dominated by the mobile gear sector between 1977 and 1989 (Table 3). Between 1990 and 1994, the fixed gear sector took a larger proportion of the landings;

however the proportion taken by the mobile gear sector increased since and was 73% in 2001.

Details about the management history of the fishery can be obtained from Hansen and Annand (1994, 1995, 1996, 1997) and Hurley et al. (1996, 1997, 1998, 1999). Several recent changes to the management of this fishery have had a significant impact on the timing of the fishery. As a result of the change to an April-March fishing year in 1999, landings in the first quarter of 2000 and 2001 were the highest since 1992 (Table 4, Figure 4 and 5). Landings in the first quarter of 2002 were also high. Both the fixed gear and mobile gear sectors indicate this is due primarily to the ability to direct for haddock with a minimal bycatch of cod at that time of year. This situation has been necessitated by the low quotas for cod in the last 3 years. The introduction of sharing arrangements in the fixed gear sector, as a result of Community Management Boards, has also contributed to this change.

The change in timing of the fishery has resulted in a change in the distribution of catches. The proportion of catches coming from 4Xn and 4Xp has been increasing in recent years (Table 4, Figure 4 and 5). While the increase in 4Xn is largely result of the increase in the winter fishery, the increases in changes in 4Xp likely reflects directing for larger haddock in deeper water.

The 2002 fishing year is progressing much like the previous two years. Although most fishermen are attempting to avoid catching cod, 70% of the overall cod quota had been landed by October 24$^{th}$, while only 56% of the haddock quota had been landed.

Reports from industry indicate that haddock abundance has been good throughout the stock area in recent years although there were reports of changes in inshore distribution. Catches of small fish have been prevalent, particularly in eastern 4X. Port samples indicate that the proportion of fish <43cm in landings from 4Xmnop by quarter and gear type was as high as 23%. Reports indicate that discarding and misreporting of 4X/5Y haddock have been minimal in recent years.

## Data

### Age Composition of the Catch

Port samples of landings were used to construct a catch-at-age for 1999, 2000, 2001 and the first half of 2002 as in previous assessments of this resource. The age composition was derived by application of age/length keys to length frequencies, stratified by quarter and gear. Due to differences in growth rates between haddock on the Scotian Shelf and in the Bay of Fundy, landings are separated into 4Xmnop and 4Xqrs5Y and separate age/length keys were used, whenever possible. Seasonal length/weight parameters derived by O'Boyle et al. (1983) were used. When insufficient samples are available to satisfy this stratification, length frequencies may need to be aggregated and a common age/length key applied. In some cases, a key from one gear, quarter or area may have to be applied to another where no otoliths are available. The gear and quarter aggregations are shown in Tables 5-8.

The resulting catch-at-age is shown in Table 9 and the catch-at-age as proportion is shown in Table 10 and Figure 5. One can see the 1993 and 1994 yearclasses recruit to the fishery at age 2 and 3 and become dominant in the fishery in 1997-1999 when they made up more than 50% of landings by number in those years. These two yearclasses still made up 33% of landings by number in 2001 and the impact of these two yearclasses can be seen through to 2002. The 1998 yearclass made up 5% of landings by number at age 2 and 22% at age 3. In the 2002 half year catch at age, the 1998 yearclass made up 36% of the landings by number.

As a routine check, the primary ager read the 4X haddock otolith reference collection. A pair-wise comparison of ages showed high precision and little bias, with an overall coefficient of variation of 2.2% (Figure 6). The results were considered acceptable.

Mean weights-at-age in the commercial landings have been variable with a modest decline since the early 1990s. The age 5 weight-at-age in recent years is similar to that since 1970, but ages 7 and older are very low compared to the 1970s and early-1980s (Table 11, Figure 7).

In 1984/1985, there was a change in the methodology used to determine ages in this resource from "crack and burn" to "thin section" (this change in methodology is not restricted to 4X haddock). Concerns have been expressed that the decreases in size-at-age observed in that period may be due to changes in the methodology, not to changes in growth rate, and this needs to be investigated.

## Research Vessel Surveys

A summer groundfish research survey of the Scotian Shelf and Bay of Fundy has been conducted in July since 1970. The stratification scheme used in this stratified random survey design is shown in Figure 2. The vessel conversion factor of 1.2 was used for the *A.T. Cameron* surveys (Fanning 1985). Catches from the 2000-2002 surveys are shown in Figure 8. Mean number per tow by stratum is shown in Table 12.

Mean number per tow of 4X haddock in 2002 declined from the high levels of the past several years but were still well above the long-term mean (Figure 9). Mean weight per tow also decreased in 2002 but was still above the long-term mean. These decreases were more pronounced in the Scotian Shelf strata (Figure 10).

A comparison of haddock ages by the primary and secondary agers showed good precision and little bias, with coefficients of variation of 3.5 and 3.4 for the 2000 and 2001 surveys respectively (Figure 11). Although there was a bias at older ages, the sample size at those ages was small and the results were considered acceptable.

Mean numbers-at-age per standard tow for the 1970-2002 summer RV surveys are shown in Table 13 and the age composition of the surveys from 1995-2002 are shown in Figure 12.

The above average 1993 and 1994 yearclasses are apparent. The 1998 and 1999 yearclasses are very strong and 2000 yearclass is also above average.

The weight per tow of ages 4+ in the RV survey, as a proxy for spawning stock biomass, was used as an indicator of abundance. Abundance has shown an increasing trend since 1993 and was above average above the long-term average in 2002 (Figure 13).

The catch per tow of ages 2 and 3 in the RV survey, adjusted by the calibration coefficients from the SPA, was used as an indicator of recruitment. Recruitment was below average from 1983 to 1992, with the exception of the 1987 and 1988 yearclasses. The 1993 and 1994 yearclasses were above average. The 1998 yearclass is the largest in the RV survey series and the 1999 yearclass is the third largest (Figure 13).

The age structure of a population reflects the quality of the population abundance. In general, a broader range of ages is more likely to represent a healthy stock. Several means of expressing this were explored, in particular the number of ages between the $10^{th}$ and $90^{th}$ percentiles in the RV survey in a year and the number of above average ages 4-10 in a year in the RV survey (Figure 14). The latter was used as an indicator of population age structure. This indicator has been increasing since 1995 and all ages were above average in 2002. This may not be the best indicator of age structure because it is insensitive to the relative contribution of older ages with the age distribution, which are thought to have a higher reproductive potential. Further work is required in this area.

Several indices can provide insight into the distributional properties of abundance. The proportion of annual survey sets where a species occurs (non-zero sets) is a measure of the area occupied by the species. The area occupied in the RV survey by haddock 43cm and greater in length (approximates ages 4+, as this calculation cannot presently be done using age data) has shown an increasing trend since the late 1980s and is near the high levels seen in the late 1970s and early 1980s (Figure 15). The area occupied by haddock 26-42cm (approximates ages 2 and 3) has shown an increasing trend since the late 1980s and is at the highest level observed in the series.

The average catch rate in the annual survey sets where a species occurs is a measure of the local density of the species. Local density in the RV survey of haddock 43cm and greater has shown an increasing trend since the early 1990s and about average in 2002 (Figure 15). The local density in the RV survey of haddock 26-42cm has been increasing since the early 1990s and is at the highest level observed in the series.

Mean lengths-at-age of haddock in 4X in the RV survey decreased through the mid- to late 1980s (Table 14, Figure 16). Some recovery occurred in the late 1980s and early 1990s, but not to the sizes of the earlier period. Mean lengths-at-age have been decreasing since the early to mid 1990s, particularly at older ages. Mean weights-at-age show similar trends (Table 15, Figure 16). Many ages are below the long-term mean length and weight and some are at the smallest size observed in the RV series. A comparison of weights-at-age from the commercial fishery and from the RV survey, show similar trends at ages 7 and 9, but some differences at age 5 in the recent period and different trends at age 3, suggesting that age 3 is

not fully recruited to the fishery and that age 5 has become less so in the last 5 years (Figure 17).

The instantaneous annual growth rate (G) calculated for length at ages 2-7 shows a long-term decreasing trend since the mid-1970s but shows some sign of stabilizing in the last few years (Figure 18). This was used as an indicator of production.

The predicted weight of a haddock at a length of 50cm is considered an index of fish condition, of relative weight at length (i.e. plumpness). This index declined through the late 1980s and early 1990s and after showing some improvement, has decreased to lowest level observed (Figure 19). Fulton's K, also an index of fish condition, shows a similar trend (Figure 19). For cod, low levels of Fulton's K have been related to poor reproductive success, and to post-spawning mortality at very low levels. Similar experiments have not been conducted for haddock. It would appear that the levels observed here for haddock have not affected reproductive success. However, poor condition does reflect low productivity. This index was used as an indicator of production.

Total mortality (Z) estimated for ages 5-7 (historically fully recruited) from the RV surveys were relatively stable in recent years with an implied fishing mortality of about $F_{0.1}$ (assuming natural mortality of 0.2) (Figure 20). Relative fishing mortality calculated from commercial catches and RV survey biomass for ages 5-7 showed an increasing trend through the 1970s to a maximum in the early 1980s, followed by a decreasing trend. Relative F increased 1992-1994, but decreased in 1995 and has remained relatively stable since (Figure 20).

Industry Survey

The mobile gear <65 ft (ITQ) fleet has conducted a joint resource survey with DFO since the summer of 1995. The survey is conducted in July, the same time that the DFO research vessel survey is conducted, by 3 draggers (<65 ft) equipped with standardized gear with the same size codend liner as used in the RV survey. A fixed station design, based on the RV survey strata, is used and standardized tows are made. The survey is designed to cover the entire 4X area, included the large inshore area off southwest Nova Scotia not covered by the RV survey. Further details are summarized in O'Boyle et al. 1995 and Hurley et al. 1999. Due to changes in the survey design between 1995, the first year of the survey, and subsequent years, the 1995 survey was not used in the time series here.

Haddock catches in the 2001 and 2002 ITQ surveys are shown in Figure 21. As with the RV survey, haddock catches are widespread throughout most of 4X, with the exception of the inshore areas off southwest Nova Scotia and in eastern 4X. Mean number and weight per tow trends and mean number-at-age per tow are shown in Table 16. Both mean number and mean weight per tow were stable 1996-1998, then increased 1999-2001 and decreased in 2002. Haddock age composition from the ITQ survey is shown in Figure 22. The 1993 and 1994 yearclasses were also above average in this survey. The 1998, 1999 and 2000

yearclasses were all strong , but catches of these yearclasses were considerably lower in 2002.

Mean weight per tow of ages 4+ from this survey was also used as an indicator of abundance and has shown an increased trend since 1996 (Figure 23). As with the RV survey, the catch per tow of ages 2 and 3 in the ITQ survey, adjusted by the calibration coefficients for this survey from the SPA, was used as an indicator of recruitment (Figure 23).

Estimation of Stock Parameters and Results

A traditional age-based Sequential Population Analysis (SPA) using the ADAPT framework (Gavaris 1988) was used to produce estimates of population abundance in numbers. The SPA model used is as follows:

Parameters:

Population numbers at mid-year $N_{i,2002}$ i = 2-10
Calibration coefficients $q_{1,i}$ i = ages 2-10 for July RV survey
$q_{2,i}$ i = ages 2-10 for ITQ survey

Structure Imposed:

Error in catch assumed negligible
Partial recruitment fixed for age 1 in 2002
F on oldest age (10) set as average F of ages 8-9 adjusted by the partial recruitment of age 10 in 2002
No intercepts were fitted
M = 0.2 for all ages

Input:

$C_{i,t}$ i = 1-10; t = 1970 to 2002 - catch-at-age for entire year (half year for 2002)
$J_{i,t}$ i = 2-10; t = 1970 to 2002 - July RV survey index
$ITQ_{i,t}$ i = 2-10; t = 1996 to 2002 - ITQ survey index

Objective function:

Minimise $\{ \sum\sum (\ln J_{i,t} - \ln q_{1,i} N_{i,t})^2 \} + \{ \sum\sum (\ln ITQ_{i,t} - \ln q_{2,i} N_{i,t})^2 \}$

Summary:

| | |
|---|---|
| Number of observations: | 297 for July RV (9 ages by 33 years) |
| | 63 for ITQ (9 ages by 7 years) |
| Number of parameters: | 27, 9 ln Ns estimated by NLLS, 18 qs algebraically |

| age | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| partial recruitment | .0001 | .004 | .055 | .205 | .503 | .814 | .918 | 1.00 | 1.00 | 1.00 |

The SPA inputs, commercial catch numbers-at-age, RV survey stratified mean numbers-at-age per tow, and ITQ survey mean numbers-at-age per tow, are shown in Tables 9, 13 and 16 respectively. Residuals from the model fit and summary statistics of overall fit of the model are shown in Table 17 and Figure 24. The resulting estimates of population numbers and biomass, and fishing mortality are shown in Table 18. As with previous assessments of this resource, the residuals show some strong year effects, with positive residuals at all ages in some years and negative residuals at all ages in other years.

Recruitment from 1983-92 was below average, although the 1987 and 1988 yearclasses were near-average in strength (Figure 25). Both the 1993 and 1994 yearclasses were above average. The 1997 yearclass was average and the 1998 yearclass is estimated to be the strongest in the time series. The model suggests that the 1999 yearclass is also very strong and that the 2000 yearclass is above average.

Spawning stock biomass (ages 4+) decreased from a peak in 1979 and reached a low of 19,000t in 1990 (Figure 25). The above average 1993 and 1994 yearclasses resulted in spawning stock biomass increasing to 41,000t in 1998. The average 1997 yearclass and the large 1998 yearclass are estimated to increase spawning stock biomass to 63,000t in 2002.

There appears to be no relationship between spawning stock biomass and recruitment over the biomass range observed (Figure 26).

The exploitation rate on ages 5-7 (historically fully recruited) increased from the 1970s to approximately 50% in the early 1980s (Figure 25). It declined to close to $F_{0.1}$ (20% exploitation, currently used value of $F_{0.1} = 0.25$) in the late 1980s and dropped below $F_{0.1}$ in 1994. Exploitation rate on ages 5-7 dropped again in 2000 and 2001. Partial recruitment has changed in recent years and fully recruited ages changed from 5-7 to 8-10. The exploitation rate on older ages has remained high at about 22% in those years.

Estimates of total mortality calculated from the RV surveys were comparable with fishing mortality estimates from the SPA (Figure 27). This implies that there has not been an increase in natural mortality in this resource, as has been the case with a number other groundfish stocks on the Scotian Shelf recently.

Past assessments of this resource have exhibited a strong retrospective pattern, where exploitation is under-estimated and population abundance is over-estimated in the current year, relative to when additional data are available in subsequent years. The pattern of exploitation estimates in this case is variable and does not show a consistent over- or under-estimation (Figure 28). The biomass estimates do exhibit a consistent pattern of over-estimation of population abundance in the most recent year, particularly when strong yearclasses occur. Retrospective estimates of yearclass size indicate that early estimates of large yearclasses may be over-estimated by a factor of at least 2 and that this pattern of over-estimation can persist at older ages (Figure 29).

Projected yield and spawning stock biomass were calculated using recent mean weights-at-age. Weights-at-age in this resource have been declining since the mid- 1990s. If this trend continues, then yield and spawning stock biomass will be over-estimated. A shift in the proportion of landings from the Bay of Fundy to the Scotian Shelf, where growth is considerably slower, would also result in yield being over-estimated.

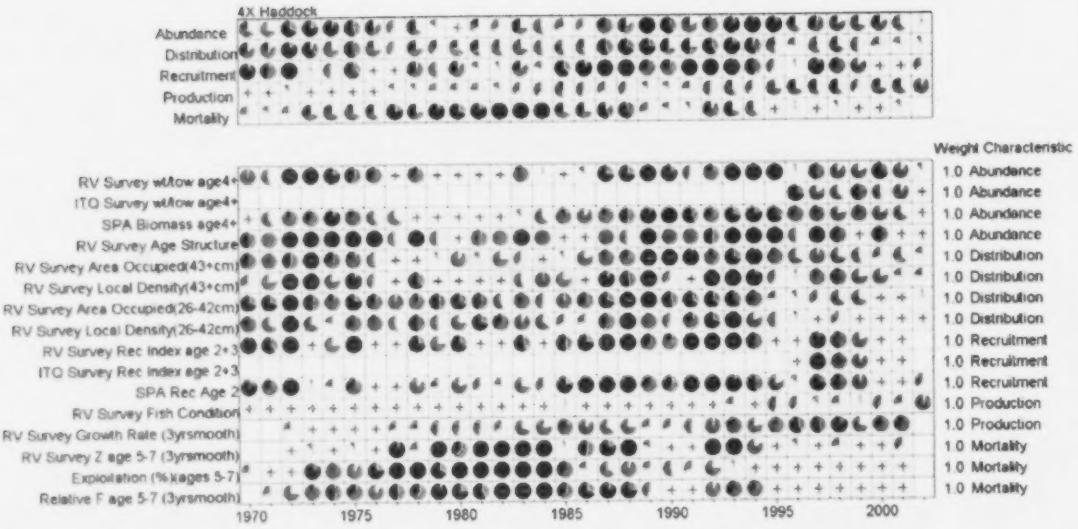
In 1984/1985, there was a change in the methodology used to determine ages in the resource from "crack and burn" to "thin section" (this change in methodology is not restricted just to 4X haddock). Concerns have been expressed that the decreases in size-at-age observed in that period may be due to changes in the methodology, not to changes in growth rate, and this needs to be investigated. This would not just effect estimates of size-at-age, but also estimates of spawning stock biomass and exploitation rates during that period.

Traffic Light Analysis

Considerable effort has gone into development of the Traffic Light Method for use in fishery management planning (see Halliday et al. 2001 and RAP 2000, 2001a, 2001b, 2001c for details).

The Traffic Light table summarises the indicators of stock status shown above. This table shows the annual values of each indicator as a combination of three lights depending on whether they are among the best values for that indicator, among the worst or in between. For indicators such as stock biomass and recruitment, high values are good and have a green light ✦ and low values are bad and have a red light ●. However, for indicators such as mortality, high values are bad and are assigned a red light whereas low values are good and receive a green light. Intermediate values (midpoint between red and green) are yellow ●. A value between red and yellow is expressed as a pie with increasing amounts of red in the pie as the value approaches the red threshold or cut point. Similarly, a value between the midpoint and the green cut point becomes increasingly green in the pie as the green cut point is approached. Empty cells in the table indicate no observation for that year. Uncertainties about the appropriate cut point resulted in a broad yellow zone.

In the traffic light analysis, indicators are summarised into groups, which emphasise specific aspects of the resource. These groupings are called characteristics; abundance, distribution, recruitment, production, and mortality. The following outlook is cast in terms of these characteristics.




See Appendix 1 for a description of the traffic light indicators, the boundary points, and the weights and rationales for these.

Contact the primary author for a colour copy of the Traffic Light Table.

## Outlook

Indicators of abundance (RV Survey wt/tow ages 4+, ITQ Survey wt/tow ages 4+, SPA Biomass ages 4+, RV Survey Age Structure) all show increasing trends in the most recent period and all indicate that the 2002 value is above average. The large increase in 2002 4+ biomass is a result of the 1998 yearclass.

Indicators of recruitment (RV Survey Recruitment Index ages 2+3, ITQ Survey Recruitment Index ages 2+3, SPA Recruitment age 2) all show that the 1998 yearclass is the strongest observed in the survey/SPA time series. The 1999 yearclass is also very strong and the 2000 yearclass may be above average. The 1993 and 1994 yearclasses were above average.

The distribution indicators (RV Survey Area Occupied 43+cm, RV Survey Local Density 43+cm, RV Survey Area Occupied 26-42cm, RV Survey Local Density 26-42cm) show that fish at lengths that approximate the spawning stock are near the widest area occupied observed and the local density is about average. The area occupied by fish at lengths that approximate recruits is at the widest observed and the local density is also at the highest.

The indicators of production (RV Survey Growth Rate, RV Survey Fish Condition) have been decreasing since the late 1970s to early 1980s and are at or near the lowest levels observed.

The indicators of mortality (RV Survey Total Mortality ages 5-7, SPA Exploitation ages 5-7, Relative Fishing Mortality ages 5-7) show that mortality has been low in recent years. It should be noted though that fully recruited ages have changed from 5-7 to 8-10 in recent years and F on these ages continues to be high.

Projected yield was calculated using the recent partial recruitment pattern. While the very strong incoming 1998 and 1999 yearclasses may result in an increase in the partial recruitment to the fishery at ages 4 and 5 in 2003, the extent of this is uncertain. Therefore the projected yield was calculated using the 1999-2001 average partial recruitment. Weights-at-age in the fishery are currently larger than those indicated for the population by the research vessel survey. Projected yield was calculated using recent weights-at-age from the fishery, but also using weights-at-age from the research vessel survey to approximate the anticipated increased contribution of catch from the Scotian Shelf stock area, if quotas and catches increase significantly. Projections using the survey weights-at-age are considered a lower bound and results closer to those using recently observed fishery weights-at-age are more likely. The table below shows projected yield at F=0.25 (currently used for $F_{0.1}$) for the 2003 fishing year and the spawning stock biomass (ages 4+) at the beginning of the 2003 fishing year.

This analysis indicates that landings of 8,100t (TAC) in the 2002 fishing year will result in an exploitation rate below $F_{0.1}$.

| Weight-at-age | 2003 SSB (t) | 2003 Yield (t) |
|---|---|---|
| high | 79,000 | 15,000 |
| low | 77,000 | 9,000 |

If fished at $F_{0.1}$, spawning stock biomass is estimated to increase to a high in 2003 and then decrease subsequently, unless further strong recruitment occurs.

It is possible to estimate the uncertainties from the model regarding stock size and then use these in a risk analysis. The risk plot incorporates the discrepancy between the accepted model and the data. Other uncertainties not considered in this risk analysis include errors in the model and model formulations, changes in fishing practices, and environmental effects on survivorship. The spawning stock biomass is currently near historically high levels; therefore a change in spawning stock biomass in not an immediate concern. Accordingly the risk analysis is done only to measure if we are keeping fishing mortality at a moderate level. The steepness of the curves indicates that the risk analysis results are relatively robust to estimation error for abundance but the distance between them indicates they are sensitive to assumptions of fishery weights-at-age (Figure 30).

Given the retrospective pattern observed in this resource in the past when strong yearclasses were present, this assessment likely over-estimates biomass.

Although we have observed high recruitment and recruits that are widely distributed at high local density, the spawners exhibit low growth rate, below average size-at-age, and lower condition. It is uncertain how this will impact future production.

In summary, high exploitation in the early 1980s, despite good recruitment, led to declines in spawning stock biomass. Although exploitation decreased to near $F_{0.1}$ in the late 1980s, declining production and poor recruitment resulted in further declines in spawning stock biomass. Improved recruitment and low exploitation in the early 1990s started stock rebuilding. Continued low exploitation since 1994 and the above average 1993 and 1994 yearclasses have allowed spawning stock biomass to continue to rebuild. The very strong 1998 and 1999 yearclasses are expected to continue this trend.

The resource is rebuilding, due to record high levels of recruitment and low recent exploitation levels. Spawning stock biomass is near the high levels of the late 1970s/early 1980s and is projected to exceed these levels in 2003 but will decrease unless further strong recruitment occurs. Thus emphasis should be on how the potential yield from the current good recruitment is to be utilized over time, and on the implications of that decision for 4X cod conservation as a result of the mixed fishery problem.

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Table 1. Reported nominal catch (t) and TAC of haddock from NAFO Division 4X.

| Year | Annual Catch | TAC | Fishing Year** Catch | TAC |
|---|---|---|---|---|
| 1960 | 15800 | | | |
| 1961 | 17918 | | | |
| 1962 | 18032 | | | |
| 1963 | 24461 | | | |
| 1964 | 36049 | | | |
| 1965 | 29166 | | | |
| 1966 | 43349 | | | |
| 1967 | 37896 | | | |
| 1968 | 32602 | | | |
| 1969 | 30703 | | | |
| 1970 | 18072 | 18000 | | |
| 1971 | 17592 | 18000 | | |
| 1972 | 13483 | 9000 | | |
| 1973 | 13106 | 9000 | | |
| 1974 | 13378 | 0 | | |
| 1975 | 18298 | 15000 | | |
| 1976 | 17498 | 15000 | | |
| 1977 | 21281 | 15000 | | |
| 1978 | 27323 | 21500 | | |
| 1979 | 25193 | 26000 | | |
| 1980 | 29210 | 28000 | | |
| 1981 | 31475 | 27850 | | |
| 1982 | 25729 | 32000 | | |
| 1983 | 27405 | 32000 | | |
| 1984 | 21156 | 32000 | | |
| 1985 | 16131 | 15000 | | |
| 1986 | 15555 | 15000 | | |
| 1987 | 13780 | 15000 | | |
| 1988 | 11272 | 12400 | | |
| 1989 | 6800 | 4600 | | |
| 1990 | 7556 | 4600 | | |
| 1991 | 9826 | 0 | | |
| 1992 | 10530 | 0 | | |
| 1993 | 6968 | 6000 | | |
| 1994 | 4406 | 4500 | | |
| 1995 | 5669 | 6000 | | |
| 1996 | 6245 | 6500 | | |
| 1997 | 6527 | 6700 | | |
| 1998 | 7843 | 8100 | | |
| 1999 | 6621 | 8100 | 9291 | 9800 |
| 2000 | 6961 | | 7761 | 8100 |
| 2001 | 8466 | | 7411 | 8100 |
| 2002* | 3937 | | 1524 | 8100 |

* - Landings to June 30th,2002

** Fishing year in 1999 was extended to Mar 31,2000. TAC prorated upwards. Subsequent fishing years begin on April 1.

Table 2. Reported nominal catch (t) of haddock from NAFO Div. 4X (Canadian landings include 5Y) by country. The numbers in brackets represent the number of commercial samples collected in that year.

| Year | Canada (MQ) | Canada (NFLD) | USA | USSR | Spain | Other | Total | TAC |
|---|---|---|---|---|---|---|---|---|
| 1970 | 16050 (26) | - | 1638 | 2 | 370 | 12 | 18072 | 18000 |
| 1971 | 16493 (29) | - | 654 | 97 | 347 | 1 | 17592 | 18000 |
| 1972 | 12593 (36) | - | 409 | 10 | 470 | 1 | 13483 | 9000 |
| 1973 | 12687 (30) | - | 265 | 14 | 134 | 6 | 13106 | 9000 |
| 1974 | 12586 (25) | - | 660 | 35 | 97 | - | 13378 | - |
| 1975 | 16139 (56) | - | 2111 | 39 | 7 | 2 | 18298 | 15000 |
| 1976 | 16426 (45) | - | 972 | - | 95 | 5 | 17498 | 15000 |
| 1977 | 19619 (79) | - | 1648 | 2 | - | 12 | 21281 | 15000 |
| 1978 | 26045 (62) | 114 | 1135 | 2 | - | 27 | 27323 | 21500 |
| 1979 | 24837 (49) | 268 | 70 | 3 | - | 15 | 25193 | 26000 |
| 1980 | 28807 (56) | 71 | 257 | 38 | - | 37 | 29210 | 28000 |
| 1981 | 30877 (82) | 117 | 466 | - | - | 15 | 31475 | 27850 |
| 1982 | 24843 (92) | 28 | 854 | - | - | 4 | 25729 | 32000 |
| 1983 | 26843 (119) | 44 | 494 | 17 | - | 7 | 27405 | 32000 |
| 1984 | 20927 (97) | 23 | 206 | - | - | - | 21156 | 32000 |
| 1985 | 16105 (86) | - | 25 | - | - | 1 | 16131 | 15000 |
| 1986 | 15507 (78) | - | 38 | 10 | - | - | 15555 | 15000 |
| 1987 | 13763 (82) | - | 17 | - | - | - | 13780 | 15000 |
| 1988 | 11217 (79) | - | 2 | 53 | - | - | 11272 | 12400 |
| 1989 | 6794 (43) | - | 1 | 5 | - | - | 6800 | 4600 |
| 1990 | 7504 (71) | - | 32 | 172 | - | 32 | 7556 | 4600 |
| 1991 | 9772 (81) | 13 | - | 382 | - | 32 | 9826 | - |
| 1992 | 10508 (89) | 51 | - | - | - | 172 | 10530 | - |
| 1993 | 6947 (86) | - | - | - | - | 212 | 6968 | 6000 |
| 1994 | 4405 (68) | - | - | - | - | 12 | 4406 | 4500 |
| 1995 | 5660 (78) | - | - | - | - | 92 | 5669 | 6000 |
| 1996 | 6237 (84) | - | - | - | - | 82 | 6245 | 6500 |
| 1997 | 6519 (87) | - | - | - | - | 82 | 6527 | 6700 |
| 1998 | 7842 (86) | - | - | - | - | 12 | 7843 | 8100 |
| 1999 | 6621 (74) | - | - | - | - | - | 6621 | 8100 |
| 2000 | 6961 (91) | - | - | 0 | - | - | 6961 | 8100 |
| 2001 | 8466 (100) | - | - | - | - | - | 8466 | 8100 |
| 2002* | 3937 (54) | - | - | - | - | - | 3937 | 8100 |

* = 2002 Data only until June 30th

Table 3. Reported nominal catch (t) of haddock from NAFO Div. 4X by tonnage class and gear type. The numbers in brackets represent the mean weight landed per age/size sample collected.

| | Tonnage Class | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | TC 1-3 | | | | | | TC 4+ | | | |
| Year | MG (OT) | | FG (LL)[1] | | Misc [2] | | MG (OT) | | FG (LL) | Misc. | Total |
| 1970 | 5510 | (1377) | 3393 | | 492 | | 6503 | (296) | 113 | 0 | 16012 |
| 1971 | 4744 | (949) | 3598 | (1199) | 260 | | 7712 | (367) | 94 | 0 | 16407 |
| 1972 | 2929 | (732) | 4472 | (447) | 357 | | 4742 | (216) | 63 | 8 | 12570 |
| 1973 | 1930 | (322) | 6124 | (680) | 285 | | 4228 | 282) | 70 | 0 | 12637 |
| 1974 | 4119 | (515) | 6391 | (533) | 200 | | 1623 | (325) | 56 | 0 | 12388 |
| 1975 | 6186 | (326) | 5194 | (577) | 246 | | 4408 | (157) | 26 | 0 | 16059 |
| 1976 | 4393 | (1098) | 5312 | (885) | 432 | (216) | 6117 | (185) | 46 | 33 | 16333 |
| 1977 | 6238 | (1040) | 4329 | (481) | 529 | | 8246 | (129) | 117 | 134 | 19593 |
| 1978 | 9694 | | 6817 | (568) | 906 | (453) | 7473 | (156) | 97 | 416 | 25404 |
| 1979 | 10555 | (5278) | 5133 | (395) | 515 | (515) | 8272 | (251) | 56 | 48 | 24580 |
| 1980 | 13471 | (1225) | 6926 | (385) | 1079 | (360) | 7046 | (294) | 82 | 0 | 28604 |
| 1981 | 14991 | (333) | 7861 | (302) | 967 | (322) | 6475 | (809) | 70 | 0 | 30364 |
| 1982 | 12120 | (252) | 7599 | (345) | 842 | (70) | 2972 | (297) | 32 | 0 | 23565 |
| 1983 | 12964 | (231) | 8548 | (225) | 751 | (75) | 2562 | (197) | 15 | 0 | 24840 |
| 1984 | 12097 | (212) | 6778 | (226) | 193 | (193) | 613 | (77) | 0 | 0 | 19682 |
| 1985 | 10292 | (181) | 4367 | (182) | 134 | | 520 | (104) | 1 | 0 | 15314 |
| 1986 | 9630 | (201) | 5345 | (184) | 99 | | 209 | (209) | 0 | 0 | 15282 |
| 1987 | 8103 | (180) | 4856 | (270) | 212 | (19) | 502 | (84) | 0 | 0 | 13673 |
| 1988 | 7174 | (133) | 3442 | (156) | 93 | (93) | 377 | (189) | 0 | 0 | 11085 |
| 1989 | 3731 | (133) | 2686 | (244) | 194 | | 90 | (22) | 0 | 0 | 6701 |
| 1990 | 3322 | (79) | 3785 | (135) | 278 | (278) | 110 | | 0 | 0 | 7495 |
| 1991 | 4171 | (97) | 5127 | (151) | 258 | (258) | 206 | (69) | 0 | 0 | 9761 |
| 1992 | 3462 | (74) | 6560 | (177) | 217 | (109) | 258 | (86) | 0 | 2 | 10500 |
| 1993 | 2620 | (61) | 4091 | (136) | 100 | (14) | 123 | (31) | 0 | 0 | 6935 |
| 1994 | 2068 | (63) | 2177 | (84) | 48 | | 97 | (48) | 0 | 0 | 4391 |
| 1995 | 3035 | (65) | 2420 | (81) | 69 | | 105 | (105) | 0 | 2 | 5631 |
| 1996 | 3593 | (86) | 2351 | (59) | 50 | (50) | 151 | (151) | 0 | 0 | 6145 |
| 1997 | 4214 | (73) | 2158 | (94) | 56 | (56) | 64 | (13) | 0 | 0 | 6493 |
| 1998 | 5154 | (99) | 2558 | (80) | 50 | | 80 | (40) | 0 | 0 | 7842 |
| 1999 | 4475 | (73) | 1995 | (249) | 31 | (31) | 120 | (17) | 0 | 0 | 6621 |
| 2000 | 4129 | (59) | 2699 | (159) | 28 | (14) | 105 | (35) | 0 | 0 | 6961 |
| 2001 | 6128 | (96) | 2229 | (64) | 21 | (11) | 88 | (88) | 0 | 0 | 8466 |
| 2002 | 3373 | (82) | 522 | (65) | 6 | (6) | 35 | (12) | 0 | 0 | 3936 |

1 = Includes Handline

2 = Gillnets (set, drift), traps, unspecified.

* = 2002 Data only until June 30

Table 4a Reported landings by month and gear type from NAFO Divisions 4X and 5Y (from ZIF) 2002 data to June 30

| | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mobile | 1985 | 331 | 2598 | 439 | 792 | 1067 | 1924 | 1306 | 856 | 1046 | 713 | 240 | 290 | 11602 |
| | 1986 | 421 | 1806 | 754 | 364 | 1021 | 900 | 871 | 688 | 1852 | 938 | 206 | 242 | 10062 |
| | 1987 | 448 | 1192 | 1739 | 520 | 1207 | 1142 | 549 | 293 | 1009 | 473 | 75 | 40 | 8687 |
| | 1988 | 1312 | 1037 | 109 | 555 | 756 | 1185 | 670 | 117 | 1103 | 469 | 89 | 248 | 7648 |
| | 1989 | 614 | 1062 | 667 | 289 | 193 | 735 | 171 | 83 | 47 | 15 | 9 | 24 | 3909 |
| | 1990 | 720 | 794 | 77 | 244 | 379 | 361 | 315 | 113 | 154 | 95 | 100 | 87 | 3439 |
| | 1991 | 280 | 508 | 122 | 159 | 449 | 589 | 440 | 195 | 280 | 235 | 319 | 811 | 4388 |
| | 1992 | 578 | 414 | 225 | 97 | 353 | 659 | 450 | 137 | 197 | 161 | 163 | 293 | 3727 |
| | 1993 | 259 | 232 | 223 | 107 | 396 | 467 | 320 | 166 | 209 | 163 | 147 | 67 | 2755 |
| | 1994 | 112 | 244 | 137 | 155 | 227 | 195 | 234 | 141 | 202 | 160 | 121 | 252 | 2178 |
| | 1995 | 246 | 375 | 518 | 117 | 162 | 185 | 207 | 188 | 269 | 292 | 188 | 402 | 3168 |
| | 1996 | 197 | 450 | 481 | 270 | 203 | 141 | 267 | 275 | 364 | 414 | 453 | 319 | 3836 |
| | 1997 | 78 | 457 | 539 | 399 | 176 | 249 | 337 | 277 | 559 | 502 | 420 | 311 | 4303 |
| | 1998 | 319 | 885 | 1033 | 511 | 99 | 170 | 320 | 304 | 492 | 259 | 340 | 504 | 5235 |
| | 1999 | 476 | 494 | 229 | 241 | 296 | 305 | 349 | 589 | 733 | 283 | 291 | 308 | 4595 |
| | 2000 | 518 | 826 | 549 | 123 | 288 | 217 | 341 | 316 | 414 | 282 | 226 | 133 | 4234 |
| | 2001 | 1049 | 502 | 1258 | 296 | 386 | 269 | 301 | 475 | 722 | 331 | 397 | 230 | 6216 |
| | 2002 | 780 | 598 | 621 | 538 | 347 | 526 | | | | | | | 3410 |
| Gillnet | 1985 | 0 | 0 | 2 | 1 | 1 | 2 | 16 | 43 | 36 | 10 | 0 | 1 | 113 |
| | 1986 | 0 | 1 | 0 | 0 | 1 | 7 | 18 | 16 | 15 | 25 | 3 | 2 | 88 |
| | 1987 | 2 | 1 | 4 | 7 | 15 | 17 | 32 | 24 | 44 | 58 | 12 | 0 | 215 |
| | 1988 | 1 | 1 | 3 | 1 | 1 | 11 | 14 | 14 | 18 | 13 | 4 | 1 | 82 |
| | 1989 | 0 | 0 | 0 | 12 | 2 | 13 | 10 | 15 | 41 | 35 | 25 | 4 | 158 |
| | 1990 | 6 | 5 | 6 | 0 | 13 | 51 | 66 | 31 | 72 | 23 | 4 | 0 | 278 |
| | 1991 | 0 | 0 | 2 | 5 | 5 | 20 | 18 | 63 | 98 | 41 | 2 | 1 | 257 |
| | 1992 | 4 | 1 | 0 | 5 | 5 | 10 | 26 | 29 | 69 | 64 | 3 | 0 | 215 |
| | 1993 | 0 | 0 | 1 | 2 | 4 | 18 | 11 | 14 | 36 | 12 | 1 | 0 | 100 |
| | 1994 | 0 | 0 | 0 | 1 | 1 | 5 | 10 | 7 | 13 | 9 | 1 | 0 | 48 |
| | 1995 | 0 | 0 | 0 | 1 | 0 | 6 | 10 | 2 | 49 | 1 | 0 | 0 | 69 |
| | 1996 | 0 | 0 | 0 | 0 | 1 | 4 | 12 | 9 | 22 | 2 | 0 | 0 | 50 |
| | 1997 | 0 | 0 | 0 | 0 | 0 | 4 | 8 | 23 | 15 | 6 | 0 | 1 | 58 |
| | 1998 | 0 | 0 | 0 | 0 | 0 | 10 | 16 | 7 | 9 | 6 | 1 | 1 | 50 |
| | 1999 | 0 | 0 | 0 | 0 | 0 | 6 | 6 | 5 | 7 | 4 | 2 | | 31 |
| | 2000 | 0 | 0 | 1 | 0 | 0 | 2 | 6 | 5 | 4 | 8 | 0 | 0 | 28 |
| | 2001 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 5 | 5 | 2 | 0 | 0 | 21 |
| | 2002 | 0 | 0 | 1 | 1 | 1 | 3 | | | | | | | 7 |
| Longline | 1985 | 457 | 1300 | 185 | 207 | 91 | 99 | 159 | 291 | 448 | 357 | 190 | 271 | 4056 |
| | 1986 | 438 | 1107 | 316 | 117 | 84 | 102 | 186 | 429 | 713 | 621 | 418 | 356 | 4888 |
| | 1987 | 718 | 1126 | 342 | 66 | 138 | 180 | 291 | 367 | 361 | 516 | 259 | 210 | 4575 |
| | 1988 | 807 | 485 | 104 | 81 | 50 | 83 | 177 | 367 | 538 | 288 | 128 | 254 | 3362 |
| | 1989 | 382 | 385 | 168 | 69 | 47 | 115 | 229 | 357 | 325 | 266 | 110 | 54 | 2506 |
| | 1990 | 645 | 463 | 205 | 48 | 33 | 107 | 265 | 382 | 555 | 270 | 202 | 216 | 3391 |
| | 1991 | 777 | 851 | 193 | 77 | 87 | 236 | 444 | 481 | 524 | 427 | 262 | 229 | 4589 |
| | 1992 | 937 | 638 | 140 | 127 | 243 | 330 | 506 | 570 | 717 | 507 | 349 | 529 | 5592 |
| | 1993 | 102 | 691 | 227 | 205 | 275 | 223 | 294 | 608 | 471 | 84 | 45 | 2 | 3228 |
| | 1994 | 292 | 36 | 2 | 53 | 41 | 236 | 352 | 158 | 180 | 116 | 98 | 16 | 1580 |
| | 1995 | 293 | 11 | 0 | 112 | 126 | 162 | 363 | 372 | 230 | 197 | 68 | 238 | 2173 |
| | 1996 | 199 | 13 | 0 | 12 | 64 | 260 | 267 | 249 | 215 | 280 | 254 | 240 | 2053 |
| | 1997 | 31 | 157 | 33 | 40 | 16 | 102 | 254 | 344 | 323 | 357 | 178 | 232 | 2066 |
| | 1998 | 99 | 54 | 71 | 139 | 32 | 152 | 352 | 316 | 507 | 378 | 161 | 201 | 2461 |
| | 1999 | 55 | 32 | 23 | 27 | 27 | 102 | 335 | 377 | 372 | 299 | 202 | 104 | 1955 |
| | 2000 | 126 | 302 | 347 | 22 | 37 | 149 | 411 | 422 | 370 | 319 | 118 | 49 | 2670 |
| | 2001 | 321 | 101 | 237 | 47 | 27 | 116 | 297 | 355 | 215 | 295 | 147 | 62 | 2219 |
| | 2002 | 199 | 64 | 149 | 29 | 13 | 62 | | | | | | | 515 |
| Handline | 1985 | 1 | 0 | 0 | 0 | 4 | 35 | 118 | 101 | 54 | 15 | 5 | 0 | 334 |
| | 1986 | 0 | 0 | 0 | 0 | 3 | 50 | 188 | 120 | 72 | 29 | 7 | 0 | 469 |
| | 1987 | 0 | 0 | 0 | 0 | 3 | 41 | 88 | 94 | 44 | 10 | 2 | 3 | 286 |
| | 1988 | 0 | 0 | 0 | 0 | 0 | 10 | 15 | 32 | 38 | 21 | 9 | 1 | 126 |
| | 1989 | 0 | 0 | 0 | 1 | 3 | 43 | 75 | 48 | 31 | 15 | 4 | 1 | 221 |
| | 1990 | 0 | 0 | 0 | 0 | 3 | 77 | 93 | 114 | 82 | 20 | 4 | 2 | 396 |
| | 1991 | 1 | 1 | 0 | 1 | 2 | 97 | 184 | 138 | 77 | 39 | 1 | 0 | 539 |
| | 1992 | 0 | 0 | 0 | 0 | 5 | 132 | 315 | 290 | 143 | 70 | 14 | 4 | 974 |
| | 1993 | 0 | 0 | 0 | 2 | 2 | 189 | 284 | 297 | 81 | 9 | 2 | 0 | 865 |
| | 1994 | 0 | 0 | 0 | 0 | 9 | 256 | 242 | 61 | 26 | 5 | 1 | 0 | 600 |
| | 1995 | 0 | 0 | 0 | 0 | 7 | 91 | 117 | 9 | 23 | 3 | 0 | 0 | 250 |
| | 1996 | 0 | 0 | 0 | 0 | 4 | 134 | 113 | 44 | 0 | 2 | 0 | 0 | 298 |
| | 1997 | 0 | 0 | 0 | 0 | 1 | 40 | 43 | 21 | 3 | 3 | 0 | 0 | 110 |
| | 1998 | 0 | 0 | 0 | 0 | 0 | 22 | 56 | 27 | 34 | 1 | 0 | 0 | 141 |
| | 1999 | 0 | 0 | 0 | 0 | 1 | 6 | 25 | 5 | 1 | 1 | 0 | 0 | 40 |
| | 2000 | 0 | 0 | 0 | 0 | 0 | 15 | 11 | 2 | 0 | 0 | 0 | 0 | 29 |
| | 2001 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 5 | 0 | 0 | 0 | 0 | 10 |
| | 2002 | 0 | 0 | 0 | 0 | 0 | 4 | | | | | | | 4 |
| Total | 1985 | 789 | 3898 | 626 | 1000 | 1164 | 2060 | 1599 | 1291 | 1585 | 1096 | 436 | 562 | 16105 |
| | 1986 | 859 | 2913 | 1071 | 481 | 1109 | 1059 | 1262 | 1254 | 2652 | 1613 | 635 | 599 | 15507 |
| | 1987 | 1168 | 2320 | 2085 | 594 | 1363 | 1381 | 961 | 777 | 1458 | 1057 | 347 | 253 | 13763 |
| | 1988 | 2119 | 1523 | 216 | 637 | 808 | 1289 | 876 | 529 | 1697 | 790 | 231 | 503 | 11217 |
| | 1989 | 996 | 1447 | 836 | 371 | 245 | 906 | 485 | 504 | 444 | 330 | 147 | 83 | 6794 |
| | 1990 | 1371 | 1262 | 288 | 293 | 429 | 597 | 739 | 640 | 864 | 408 | 309 | 305 | 7504 |
| | 1991 | 1057 | 1361 | 318 | 241 | 542 | 942 | 1086 | 877 | 978 | 742 | 585 | 1042 | 9772 |
| | 1992 | 1519 | 1052 | 366 | 228 | 606 | 1131 | 1297 | 1027 | 1127 | 801 | 529 | 825 | 10508 |
| | 1993 | 361 | 924 | 452 | 316 | 676 | 897 | 909 | 1085 | 797 | 267 | 195 | 69 | 6947 |
| | 1994 | 404 | 280 | 139 | 209 | 278 | 692 | 838 | 366 | 421 | 289 | 220 | 268 | 4405 |
| | 1995 | 539 | 387 | 518 | 230 | 314 | 445 | 697 | 570 | 572 | 492 | 256 | 640 | 5660 |
| | 1996 | 396 | 463 | 481 | 282 | 273 | 539 | 659 | 578 | 602 | 699 | 707 | 559 | 6237 |
| | 1997 | 109 | 614 | 572 | 439 | 194 | 395 | 642 | 664 | 899 | 867 | 598 | 544 | 6538 |
| | 1998 | 419 | 939 | 1103 | 650 | 132 | 354 | 743 | 654 | 1042 | 645 | 503 | 705 | 7887 |
| | 1999 | 531 | 526 | 252 | 269 | 324 | 420 | 716 | 976 | 1114 | 587 | 495 | 412 | 6621 |
| | 2000 | 644 | 1129 | 897 | 146 | 325 | 383 | 769 | 745 | 788 | 609 | 344 | 182 | 6961 |
| | 2001 | 1371 | 603 | 1496 | 343 | 413 | 389 | 606 | 840 | 942 | 628 | 545 | 292 | 8466 |
| | 2002 | 980 | 662 | 771 | 568 | 361 | 595 | | | | | | | 3936 |

Table 4b. Reported landings by unit area and gear type from NAFO Divisions 4X and 5Y (from ZIF) 2002 data to June 30

| | | 4XL | 4XM | 4XN | 4XO | 4XP | 4XQ | 4XR | 4XS | 4XU | 5Y | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mobile | 1985 | 0 | 144 | 1455 | 1949 | 1401 | 1930 | 1330 | 277 | 2326 | 791 | 11602 |
| | 1986 | 1 | 295 | 1624 | 1329 | 538 | 2254 | 910 | 198 | 2690 | 224 | 10062 |
| | 1987 | 0 | 132 | 2194 | 1059 | 901 | 1221 | 210 | 63 | 2823 | 83 | 8687 |
| | 1988 | 0 | 269 | 1007 | 728 | 963 | 559 | 107 | 22 | 3896 | 97 | 7648 |
| | 1989 | 0 | 41 | 733 | 454 | 1047 | 566 | 207 | 12 | 761 | 89 | 3909 |
| | 1990 | 0 | 35 | 468 | 533 | 738 | 886 | 223 | 5 | 543 | 7 | 3439 |
| | 1991 | 0 | 16 | 786 | 851 | 645 | 1153 | 739 | 87 | 93 | 11 | 4382 |
| | 1992 | 0 | 32 | 939 | 735 | 427 | 912 | 604 | 51 | 21 | 6 | 3727 |
| | 1993 | 0 | 7 | 503 | 500 | 355 | 925 | 296 | 108 | 50 | 12 | 2755 |
| | 1994 | 0 | 3 | 187 | 445 | 104 | 999 | 311 | 112 | 2 | 14 | 2178 |
| | 1995 | 0 | 7 | 222 | 275 | 1018 | 975 | 477 | 157 | 8 | 28 | 3168 |
| | 1996 | 0 | 10 | 541 | 214 | 758 | 995 | 800 | 413 | 14 | 92 | 3836 |
| | 1997 | 1 | 11 | 407 | 173 | 1063 | 860 | 1121 | 627 | 14 | 25 | 4303 |
| | 1998 | 0 | 25 | 1954 | 108 | 867 | 803 | 1013 | 404 | 4 | 56 | 5234 |
| | 1999 | 0 | 21 | 825 | 143 | 1402 | 932 | 709 | 516 | 6 | 41 | 4595 |
| | 2000 | 0 | 16 | 1157 | 93 | 1141 | 941 | 468 | 387 | 0 | 30 | 4234 |
| | 2001 | 0 | 22 | 1790 | 181 | 1702 | 980 | 762 | 727 | 2 | 50 | 6216 |
| | 2002 | 0 | 0 | 1129 | 191 | 560 | 482 | 809 | 214 | 2 | 22 | 3409 |
| Gillnet | 1985 | 0 | 29 | 0 | 67 | 0 | 0 | 1 | 12 | 4 | 0 | 113 |
| | 1986 | 0 | 31 | 0 | 47 | 0 | 0 | 1 | 7 | 1 | 1 | 88 |
| | 1987 | 0 | 95 | 0 | 90 | 2 | 0 | 1 | 18 | 3 | 6 | 215 |
| | 1988 | 0 | 40 | 2 | 26 | 3 | 0 | 2 | 1 | 8 | 0 | 81 |
| | 1989 | 0 | 96 | 0 | 47 | 0 | 2 | 0 | 2 | 10 | 0 | 158 |
| | 1990 | 0 | 82 | 1 | 74 | 3 | 75 | 31 | 1 | 11 | 0 | 278 |
| | 1991 | 0 | 79 | 2 | 144 | 5 | 12 | 2 | 3 | 10 | 0 | 257 |
| | 1992 | 0 | 79 | 5 | 42 | 1 | 53 | 3 | 7 | 23 | 1 | 215 |
| | 1993 | 0 | 21 | 3 | 46 | 6 | 8 | 3 | 1 | 12 | 1 | 100 |
| | 1994 | 0 | 4 | 0 | 21 | 3 | 4 | 3 | 0 | 11 | 1 | 48 |
| | 1995 | 0 | 5 | 4 | 20 | 7 | 11 | 3 | 3 | 16 | 0 | 69 |
| | 1996 | 0 | 10 | 1 | 17 | 6 | 4 | 1 | 7 | 3 | 0 | 50 |
| | 1997 | 0 | 5 | 0 | 12 | 29 | 4 | 1 | 2 | 4 | 1 | 57 |
| | 1998 | 0 | 7 | 1 | 6 | 22 | 8 | 2 | 2 | 2 | 1 | 51 |
| | 1999 | 0 | 7 | 0 | 3 | 9 | 5 | 1 | 4 | 1 | 1 | 31 |
| | 2000 | 0 | 5 | 0 | 1 | 10 | 4 | 1 | 6 | 0 | 0 | 28 |
| | 2001 | 0 | 7 | 0 | 1 | 2 | 6 | 1 | 3 | 1 | 0 | 21 |
| | 2002 | 0 | 1 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 6 |
| Longline | 1985 | 0 | 493 | 485 | 1545 | 528 | 33 | 86 | 6 | 858 | 0 | 4034 |
| | 1986 | 0 | 856 | 432 | 1924 | 486 | 11 | 61 | 6 | 1100 | 0 | 4875 |
| | 1987 | 10 | 552 | 286 | 1798 | 391 | 54 | 33 | 2 | 1445 | 2 | 4572 |
| | 1988 | 0 | 359 | 403 | 791 | 247 | 30 | 18 | 21 | 1446 | 35 | 3350 |
| | 1989 | 0 | 256 | 219 | 861 | 277 | 28 | 9 | 1 | 814 | 4 | 2469 |
| | 1990 | 0 | 275 | 229 | 1309 | 368 | 30 | 3 | 8 | 1168 | 1 | 3391 |
| | 1991 | 0 | 409 | 561 | 1809 | 801 | 97 | 45 | 1 | 863 | 0 | 4588 |
| | 1992 | 0 | 133 | 458 | 2276 | 319 | 98 | 181 | 2 | 2119 | 1 | 5587 |
| | 1993 | 0 | 113 | 1129 | 994 | 400 | 178 | 202 | 1 | 211 | 0 | 3227 |
| | 1994 | 0 | 50 | 175 | 663 | 171 | 10 | 39 | 0 | 470 | 0 | 1578 |
| | 1995 | 0 | 82 | 672 | 616 | 435 | 149 | 13 | 3 | 200 | 0 | 2171 |
| | 1996 | 0 | 68 | 556 | 678 | 351 | 84 | 66 | 6 | 243 | 0 | 2053 |
| | 1997 | 0 | 73 | 616 | 490 | 380 | 61 | 30 | 8 | 391 | 0 | 2049 |
| | 1998 | 7 | 109 | 583 | 652 | 805 | 124 | 20 | 6 | 112 | 3 | 2421 |
| | 1999 | 0 | 150 | 321 | 678 | 708 | 31 | 22 | 2 | 43 | 1 | 1955 |
| | 2000 | 0 | 202 | 903 | 752 | 636 | 44 | 40 | 3 | 89 | 1 | 2670 |
| | 2001 | 0 | 199 | 930 | 478 | 474 | 35 | 29 | 5 | 70 | 1 | 2219 |
| | 2002 | 0 | 26 | 392 | 52 | 18 | 7 | 17 | 1 | 3 | 1 | 517 |
| Handline | 1985 | 0 | 23 | 0 | 294 | 0 | 11 | 6 | 0 | 0 | 0 | 334 |
| | 1986 | 0 | 17 | 0 | 426 | 0 | 15 | 10 | 1 | 0 | 0 | 469 |
| | 1987 | 0 | 33 | 0 | 236 | 4 | 8 | 4 | 1 | 0 | 0 | 286 |
| | 1988 | 0 | 5 | 0 | 111 | 0 | 2 | 4 | 2 | 3 | 0 | 126 |
| | 1989 | 0 | 4 | 0 | 193 | 0 | 4 | 12 | 0 | 8 | 0 | 221 |
| | 1990 | 0 | 3 | 0 | 376 | 0 | 8 | 3 | 0 | 6 | 0 | 396 |
| | 1991 | 0 | 11 | 0 | 460 | 0 | 30 | 29 | 0 | 9 | 0 | 539 |
| | 1992 | 0 | 13 | 0 | 844 | 1 | 40 | 74 | 0 | 2 | 0 | 974 |
| | 1993 | 0 | 3 | 7 | 775 | 27 | 14 | 32 | 3 | 3 | 0 | 865 |
| | 1994 | 0 | 1 | 2 | 486 | 21 | 75 | 11 | 0 | 4 | 0 | 600 |
| | 1995 | 0 | 0 | 2 | 140 | 13 | 3 | 0 | 0 | 91 | 0 | 250 |
| | 1996 | 0 | 2 | 5 | 248 | 13 | 14 | 3 | 1 | 13 | 0 | 298 |
| | 1997 | 0 | 1 | 1 | 72 | 5 | 6 | 2 | 0 | 23 | 0 | 109 |
| | 1998 | 0 | 1 | 1 | 111 | 2 | 8 | 0 | 0 | 14 | 0 | 137 |
| | 1999 | 0 | 1 | 1 | 25 | 1 | 8 | 2 | 0 | 1 | 0 | 40 |
| | 2000 | 0 | 1 | 0 | 9 | 5 | 9 | 3 | 0 | 2 | 0 | 29 |
| | 2001 | 0 | 0 | 0 | 7 | 1 | 1 | 0 | 0 | 0 | 0 | 10 |
| | 2002 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 4 |
| Total | 1985 | 0 | 699 | 1941 | 3861 | 1928 | 1974 | 1426 | 295 | 3191 | 791 | 16105 |
| | 1986 | 1 | 1203 | 2055 | 3732 | 1023 | 2280 | 982 | 212 | 3794 | 225 | 15507 |
| | 1987 | 10 | 814 | 2481 | 3183 | 1297 | 1283 | 249 | 84 | 4271 | 90 | 13763 |
| | 1988 | 0 | 673 | 1412 | 1656 | 1212 | 597 | 131 | 46 | 5358 | 132 | 11217 |
| | 1989 | 0 | 432 | 952 | 1557 | 1324 | 599 | 228 | 15 | 1593 | 92 | 6794 |
| | 1990 | 0 | 396 | 698 | 2292 | 1108 | 999 | 259 | 14 | 1729 | 9 | 7504 |
| | 1991 | 0 | 515 | 1349 | 3264 | 1452 | 1292 | 816 | 91 | 975 | 12 | 9766 |
| | 1992 | 0 | 259 | 1402 | 3898 | 749 | 1104 | 862 | 60 | 2166 | 8 | 10508 |
| | 1993 | 0 | 144 | 1642 | 2316 | 788 | 1124 | 533 | 112 | 276 | 13 | 6947 |
| | 1994 | 0 | 58 | 365 | 1618 | 298 | 1088 | 364 | 113 | 487 | 15 | 4405 |
| | 1995 | 0 | 95 | 900 | 1052 | 1473 | 1139 | 493 | 164 | 316 | 28 | 5660 |
| | 1996 | 0 | 89 | 1103 | 1158 | 1127 | 1097 | 870 | 427 | 274 | 92 | 6237 |
| | 1997 | 1 | 90 | 1025 | 746 | 1477 | 931 | 1154 | 638 | 431 | 25 | 6518 |
| | 1998 | 7 | 142 | 2539 | 877 | 1696 | 943 | 1035 | 412 | 132 | 60 | 7843 |
| | 1999 | 0 | 180 | 1147 | 848 | 2120 | 976 | 733 | 522 | 51 | 42 | 6621 |
| | 2000 | 0 | 224 | 2060 | 856 | 1791 | 998 | 512 | 396 | 92 | 32 | 6961 |
| | 2001 | 0 | 228 | 2720 | 667 | 2179 | 1022 | 792 | 735 | 72 | 51 | 8466 |
| | 2002 | 0 | 27 | 1521 | 246 | 580 | 493 | 826 | 215 | 5 | 23 | 3936 |

Table 5. Summary of commercial samples for the Div. 4X haddock fishery for 1999.

Otter Trawls

| | 4Xmnop | | 4Xqrs5Y | |
|---|---|---|---|---|
| Quarter | TC 1-3 | TC 4+ | TC 1-3 | TC 4+ |
| 1 | 992 (4624-476) | 69 (1124-125) | 139 (848-115) | 1 |
| 2 | 299 (1300-160) | 1 | 537 (1678-236) | 4 (220-28) |
| 3 | 658 (1802-184) | 20 | 987 (904-97) | 7 |
| 4 | 343 (835-90) | 10 | 520 (1204-117) | 9 |

Longline/handline/Misc

| | 4Xmnop | | 4Xqrs5Y | |
|---|---|---|---|---|
| Quarter | TC 1-3 | TC 4+ | TC 1-3 | TC 4+ |
| 1 | 108 (220-0) | - | - | - |
| 2 | 136 | - | 28 | - |
| 3 | 1084 (1031-56) | - | 32 | - |
| 4 | 601 (410-32) | - | 6 | - |

Miscellaneous

| | 4Xmnop | | 4Xqrs5Y | |
|---|---|---|---|---|
| Quarter | TC 1-3 | TC 4+ | TC 1-3 | TC 4+ |
| 1 | - | - | - | - |
| 2 | 5 | - | 2 | - |
| 3 | 10 | - | 9 | - |
| 4 | 5 | - | 1 | - |

Values are tonnes landed followed by the number of fish measured and number of fish aged in parentheses. The boxes represent the aggregation used in age-length key formation.

Table 6. Summary of commercial samples for the Div. 4X haddock fishery for 2000.

Otter Trawls

| | 4Xmnop | | 4Xqrs5Y | |
|---|---|---|---|---|
| Quarter | TC 1-3 | TC 4+ | TC 1-3 | TC 4+ |
| 1 | 1482 (3803-520) | 73 (646- 47) | 325 (1816-191) | 14 |
| 2 | 175 (1591-125) | 1 | 446 (1445-139) | 6 |
| 3 | 392 (1683-197) | 8 | 668 (1855-265) | 3 |
| 4 | 276 (1507-165) | - | 365 (1301-156) | - |

Longline/handline

| | 4Xmnop | | 4Xqrs5Y | |
|---|---|---|---|---|
| Quarter | TC 1-3 | TC 4+ | TC 1-3 | TC 4+ |
| 1 | 762 ( 1065 - 112 ) | - | 12 | - |
| 2 | 179 (506- 25 ) | - | 44 ( 210 - 23 ) | - |
| 3 | 1100 ( 820 - 91 ) | - | 116 | - |
| 4 | 468 ( 923 - 109 ) | - | 18 | - |

Miscellaneous

| | 4Xmnop | | 4Xqrs5Y | |
|---|---|---|---|---|
| Quarter | TC 1-3 | TC 4+ | TC 1-3 | TC 4+ |
| 1 | 2 ( 153 -27 ) | - | - | - |
| 2 | 1 | - | 2 | - |
| 3 | 7 | - | 9 | - |
| 4 | 7 (178 - 0 ) | - | 1 | - |

Values are tonnes landed followed by the number of fish measured and number of fish aged in parentheses. The boxes represent the aggregation used in age-length key formation.

Table 7. Summary of commercial samples for the Div. 4X haddock fishery for 2001.

Otter Trawls

| | 4Xmnop | | 4Xqrs5Y | |
|---|---|---|---|---|
| Quarter | TC 1-3 | TC 4+ | TC 1-3 | TC 4+ |
| 1 | 2076( 2681-314) | 61(218-25) | 656(2300-275) | 17 |
| 2 | 384(2060-196) | 1 | 565(2356-282) | - |
| 3 | 764(2244-189) | 1 | 734(1118-128) | - |
| 4 | 402(1927-141) | 7 | 548(685-59) | - |

Longline/handline

| | 4Xmnop | | 4Xqrs5Y | |
|---|---|---|---|---|
| Quarter | TC 1-3 | TC 4+ | TC 1-3 | TC 4+ |
| 1 | 658(1801-178) | - | - | - |
| 2 | 155 (835-25) | - | 38 (865-31) | - |
| 3 | 843 (1744-140) | - | 31 | - |
| 4 | 499 (2189-182) | - | 6 | - |

Miscellaneous

| | 4Xmnop | | 4Xqrs5Y | |
|---|---|---|---|---|
| Quarter | TC 1-3 | TC 4+ | TC 1-3 | TC 4+ |
| 1 | 1(86-20) | - | 1 | - |
| 2 | 1 | - | 1 | - |
| 3 | 8 | - | 8(42-17) | - |
| 4 | 1 | - | 1 | - |

Values are tonnes landed followed by the number of fish measured and number of fish aged in parentheses. The boxes represent the aggregation used in age-length key formation.

Table 8. Summary of commercial samples for the Div. 4X haddock fishery for 2002.

Otter Trawls

| | 4Xmnop | | 4Xqrs5Y | |
|---|---|---|---|---|
| Quarter | TC 1-3 | TC 4+ | TC 1-3 | TC 4+ |
| 1 | 1323 (4032-423) | 12 (199-23) | 641 (1593-160) | 23 (400-43) |
| 2 | 544 (1196-106) | - | 865 (2671-254) | - |

Longline/handline

| | 4Xmnop | | 4Xqrs5Y | |
|---|---|---|---|---|
| Quarter | TC 1-3 | TC 4+ | TC 1-3 | TC 4+ |
| 1 | 410 (1649-153) | - | 2 | - |
| 2 | 85 (235-0) | - | 25 | - |

Miscellaneous

| | 4Xmnop | | 4Xqrs5Y | |
|---|---|---|---|---|
| Quarter | TC 1-3 | TC 4+ | TC 1-3 | TC 4+ |
| 1 | 1 | - | 1 | - |
| 2 | 1 | - | 3 (99-0) | - |

Values are tonnes landed followed by the number of fish measured and number of fish aged in parentheses. The boxes represent the aggregation used in age-length key formation.

Table 9 4X haddock commercial catch-at-age (000's)

| | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 42 | 152 | 1 | 37 | 18 | 2 | 0 | 0 | 16 | 1 | 0 | 0 | 2 | 0 |
| 2 | 1088 | 809 | 22 | 3114 | 713 | 2196 | 1306 | 1289 | 77 | 83 | 164 | 1210 | 526 | 70 | 763 | 228 |
| 3 | 747 | 1660 | 3490 | 114 | 4783 | 4617 | 1657 | 3137 | 3453 | 1184 | 2497 | 2268 | 3895 | 3621 | 1195 | 2105 |
| 4 | 1549 | 609 | 1871 | 2274 | 318 | 5220 | 4295 | 2026 | 7221 | 6862 | 3071 | 6369 | 2648 | 6020 | 5046 | 2455 |
| 5 | 391 | 1460 | 517 | 1080 | 1829 | 490 | 3712 | 3204 | 2156 | 3970 | 5527 | 4300 | 4954 | 4104 | 3708 | 4658 |
| 6 | 541 | 415 | 656 | 533 | 523 | 1115 | 437 | 2891 | 2916 | 1094 | 3573 | 3272 | 1823 | 2454 | 2583 | 1508 |
| 7 | 4679 | 71 | 91 | 607 | 194 | 250 | 813 | 361 | 1071 | 1272 | 538 | 1191 | 1560 | 1033 | 1022 | 509 |
| 8 | 1922 | 3404 | 58 | 326 | 277 | 174 | 155 | 390 | 141 | 269 | 636 | 366 | 364 | 434 | 367 | 136 |
| 9 | 137 | 1047 | 1185 | 262 | 191 | 63 | 72 | 107 | 110 | 58 | 173 | 331 | 196 | 206 | 119 | 51 |
| 10 | 99 | 167 | 520 | 621 | 277 | 32 | 96 | 72 | 27 | 70 | 35 | 99 | 101 | 131 | 83 | 16 |
| 11 | 181 | 186 | 26 | 56 | 567 | 167 | 39 | 23 | 9 | 11 | 21 | 14 | 48 | 76 | 39 | 7 |
| 12 | 28 | 150 | 196 | 13 | 25 | 231 | 104 | 8 | 6 | 1 | 3 | 24 | 17 | 27 | 22 | 4 |
| 13 | 36 | 108 | 93 | 6 | 4 | 11 | 158 | 87 | 49 | 18 | 10 | 9 | 15 | 27 | 13 | 2 |
| 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 13 | 13 | 0 | 3 | 8 | 22 | 10 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 90 | 214 | 190 | 403 | 52 | 141 | 139 | 98 | 99 | 37 | 13 | 31 | 35 | 241 | 62 | 1 |
| 3 | 1043 | 512 | 497 | 1422 | 1304 | 243 | 709 | 368 | 757 | 809 | 526 | 149 | 433 | 423 | 1370 | 93 |
| 4 | 3030 | 1016 | 499 | 394 | 2351 | 2523 | 520 | 632 | 694 | 993 | 1676 | 1052 | 503 | 766 | 854 | 1137 |
| 5 | 4588 | 896 | 936 | 358 | 580 | 2290 | 1828 | 327 | 617 | 682 | 1008 | 1795 | 1168 | 578 | 713 | 344 |
| 6 | 2096 | 1968 | 310 | 472 | 246 | 229 | 1070 | 971 | 238 | 428 | 455 | 1137 | 882 | 1164 | 517 | 323 |
| 7 | 291 | 871 | 720 | 391 | 310 | 247 | 170 | 269 | 449 | 355 | 269 | 536 | 569 | 885 | 1133 | 300 |
| 8 | 56 | 894 | 460 | 654 | 200 | 331 | 106 | 24 | 421 | 439 | 138 | 329 | 244 | 527 | 885 | 512 |
| 9 | 7 | 372 | 504 | 277 | 310 | 237 | 73 | 17 | 162 | 355 | 110 | 181 | 55 | 210 | 396 | 299 |
| 10 | 9 | 209 | 255 | 204 | 280 | 240 | 46 | 13 | 24 | 130 | 94 | 192 | 47 | 108 | 156 | 116 |
| 11 | 6 | 146 | 57 | 61 | 142 | 132 | 58 | 20 | 26 | 17 | 35 | 140 | 58 | 32 | 28 | 53 |
| 12 | 0 | 49 | 81 | 48 | 169 | 152 | 51 | 15 | 18 | 1 | 4 | 31 | 26 | 8 | 18 | 11 |
| 13 | 0 | 44 | 30 | 9 | 71 | 36 | 12 | 7 | 11 | 3 | 2 | 6 | 5 | 14 | 12 | 2 |
| 14 | 0 | 22 | 12 | 9 | 13 | 15 | 7 | 1 | 11 | 1 | 0 | 8 | 0 | 4 | 18 | 1 |
| 15 | 0 | 7 | 4 | 2 | 4 | 2 | 1 | 0 | 3 | 1 | 0 | 5 | 0 | 3 | 4 | 0 |
| 16 | 0 | 4 | 0 | 1 | 4 | 2 | 0 | 1 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 |

* = 2002 Data only until June 30

Table 10 4X haddock commercial catch-at-age (percent at age)

| | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0.5 | 1.7 | 0.0 | 0.3 | 0.1 | 0.0 | 0 | 0 | 0.1 | 0.0 | 0 | 0 | 0.0 | 0 |
| 2 | 9.5 | 7.9 | 0.3 | 34.0 | 7.3 | 15.0 | 10.2 | 9.5 | 0.4 | 0.6 | 1.0 | 6.2 | 3.3 | 0.4 | 5.1 | 2.0 |
| 3 | 6.6 | 16.1 | 39.8 | 1.2 | 49.3 | 31.6 | 12.9 | 23.1 | 20.0 | 8.0 | 15.4 | 11.7 | 24.1 | 19.9 | 8.0 | 16.0 |
| 4 | 13.6 | 7.9 | 21.3 | 24.8 | 1.3 | 35.7 | 33.4 | 14.9 | 41.9 | 46.1 | 16.9 | 32.7 | 16.4 | 33.1 | 33.7 | 21.0 |
| 5 | 3.4 | 14.2 | 5.9 | 11.8 | 18.9 | 3.4 | 26.9 | 23.6 | 12.5 | 26.7 | 34.0 | 22.1 | 30.7 | 22.5 | 24.8 | 39.9 |
| 6 | 4.7 | 4.0 | 7.5 | 5.8 | 5.4 | 7.6 | 3.4 | 21.3 | 16.9 | 7.3 | 22.0 | 16.8 | 11.3 | 13.5 | 17.3 | 12.9 |
| 7 | 41.0 | 0.7 | 1.0 | 6.6 | 2.0 | 1.7 | 6.3 | 2.7 | 6.2 | 8.5 | 3.3 | 6.1 | 9.7 | 5.7 | 6.6 | 4.4 |
| 8 | 16.9 | 33.1 | 0.7 | 3.6 | 2.9 | 1.2 | 1.2 | 2.9 | 0.6 | 1.8 | 3.9 | 1.9 | 2.3 | 2.4 | 2.5 | 1.2 |
| 9 | 1.2 | 10.2 | 13.5 | 2.9 | 2.0 | 0.4 | 0.6 | 0.8 | 0.6 | 0.4 | 1.1 | 1.7 | 1.2 | 1.1 | 0.8 | 0.4 |
| 10 | 0.9 | 1.6 | 5.9 | 6.8 | 2.9 | 0.2 | 0.7 | 0.5 | 0.2 | 0.5 | 0.2 | 0.5 | 0.6 | 0.7 | 0.6 | 0.1 |
| 11 | 1.6 | 1.8 | 0.3 | 0.6 | 5.8 | 1.1 | 0.3 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.3 | 0.4 | 0.3 | 0.1 |
| 12 | 0.2 | 1.5 | 2.2 | 0.1 | 0.3 | 1.6 | 0.8 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 |
| 13 | 0.3 | 1.0 | 1.1 | 0.1 | 0.0 | 0.1 | 1.2 | 0.6 | 0.3 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.1 | 0.0 |
| 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0.2 | 0.3 | 0 | 0.0 | 0.1 | 0.5 | 0.4 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0.8 | 3.0 | 4.2 | 8.6 | 0.9 | 2.1 | 2.9 | 3.5 | 2.8 | 0.9 | 0.3 | 0.6 | 0.9 | 4.9 | 1.0 | 0.0 |
| 3 | 9.3 | 7.1 | 10.9 | 30.2 | 21.6 | 3.6 | 14.7 | 13.3 | 21.4 | 19.0 | 12.1 | 2.7 | 10.8 | 8.5 | 22.2 | 2.9 |
| 4 | 27.0 | 14.0 | 10.9 | 8.4 | 38.9 | 37.0 | 10.8 | 22.8 | 19.6 | 23.3 | 38.7 | 18.8 | 12.5 | 15.4 | 13.9 | 35.6 |
| 5 | 40.9 | 12.4 | 20.5 | 7.6 | 9.6 | 33.5 | 38.0 | 11.8 | 17.5 | 16.0 | 23.3 | 32.1 | 29.0 | 11.6 | 11.6 | 10.6 |
| 6 | 18.7 | 27.2 | 6.8 | 10.0 | 4.1 | 3.4 | 22.2 | 35.0 | 6.7 | 10.1 | 10.5 | 20.3 | 21.9 | 23.4 | 8.4 | 10.1 |
| 7 | 2.6 | 12.0 | 15.8 | 8.3 | 5.1 | 3.6 | 3.5 | 9.7 | 12.7 | 8.3 | 6.2 | 9.6 | 14.1 | 17.8 | 18.4 | 9.4 |
| 8 | 0.5 | 12.4 | 10.1 | 13.9 | 3.3 | 4.8 | 2.2 | 0.9 | 11.9 | 10.3 | 3.2 | 5.9 | 6.1 | 10.6 | 14.4 | 16.0 |
| 9 | 0.1 | 5.1 | 11.0 | 5.9 | 5.1 | 3.5 | 1.5 | 0.6 | 4.6 | 8.3 | 2.5 | 3.2 | 1.4 | 4.2 | 6.4 | 9.4 |
| 10 | 0.1 | 2.9 | 5.6 | 4.3 | 4.6 | 3.5 | 1.0 | 0.5 | 0.7 | 3.1 | 2.2 | 3.4 | 1.2 | 2.2 | 2.5 | 3.6 |
| 11 | 0.1 | 2.0 | 1.2 | 1.3 | 2.4 | 1.9 | 1.2 | 0.7 | 0.7 | 0.4 | 0.8 | 2.5 | 1.4 | 0.6 | 0.5 | 1.7 |
| 12 | 0 | 0.7 | 1.8 | 1.0 | 2.8 | 2.2 | 1.1 | 0.5 | 0.5 | 0.0 | 0.1 | 0.6 | 0.6 | 0.2 | 0.3 | 0.4 |
| 13 | 0 | 0.6 | 0.7 | 0.2 | 1.2 | 0.5 | 0.2 | 0.3 | 0.3 | 0.1 | 0.0 | 0.1 | 0.1 | 0.3 | 0.2 | 0.1 |
| 14 | 0 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.1 | 0.0 | 0.3 | 0.0 | 0 | 0.1 | 0.0 | 0.1 | 0.3 | 0.0 |
| 15 | 0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0 | 0.1 | 0.0 | 0 | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 |
| 16 | 0 | 0.1 | 0 | 0.0 | 0.1 | 0.0 | 0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 | 0 |

* = 2002 Data only until June 30

Table 11 4X Haddock commercial weight-at-age (kg)

| | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.29 | 0.29 | 0.29 | 0.27 | 0.18 | 0.23 | 0.23 | 0.28 | 0.29 | 0.29 | 0.16 | 0.23 | | | 0.25 | |
| 2 | 0.57 | 0.5 | 0.45 | 0.51 | 0.46 | 0.52 | 0.52 | 0.46 | 0.44 | 0.51 | 0.522 | 0.593 | 0.493 | 0.394 | 0.527 | 0.573 |
| 3 | 0.9 | 0.96 | 0.9 | 0.75 | 0.82 | 0.82 | 0.81 | 0.71 | 0.87 | 0.87 | 0.882 | 0.877 | 0.907 | 0.758 | 0.785 | 0.83 |
| 4 | 1.05 | 1.25 | 1.35 | 1.25 | 1.1 | 1.2 | 1.19 | 1.22 | 1.33 | 1.33 | 1.326 | 1.26 | 1.294 | 1.141 | 1.069 | 1.071 |
| 5 | 1.16 | 1.4 | 1.6 | 1.8 | 1.7 | 1.55 | 1.6 | 1.72 | 1.65 | 1.84 | 1.777 | 1.721 | 1.653 | 1.714 | 1.411 | 1.408 |
| 6 | 1.43 | 1.5 | 1.75 | 2 | 2.3 | 2.25 | 2.1 | 2.2 | 2.33 | 2.36 | 2.355 | 2.219 | 2.13 | 2.146 | 1.932 | 1.966 |
| 7 | 1.65 | 1.75 | 1.9 | 2.2 | 2.5 | 2.65 | 2.95 | 2.94 | 2.7 | 2.83 | 2.906 | 2.654 | 2.577 | 2.607 | 2.287 | 2.442 |
| 8 | 1.95 | 1.95 | 2.1 | 2.3 | 2.6 | 3 | 3.5 | 3.3 | 3.39 | 3.3 | 3.278 | 3.134 | 2.947 | 2.869 | 2.683 | 2.92 |
| 9 | 2.3 | 2.3 | 2.3 | 2.5 | 2.8 | 3.2 | 3.6 | 3.57 | 3.77 | 4.03 | 3.811 | 3.608 | 3.47 | 3.108 | 3.054 | 3.501 |
| 10 | 2.62 | 2.65 | 2.8 | 2.7 | 2.95 | 3.45 | 3.8 | 3.77 | 4.17 | 4.15 | 4.332 | 3.688 | 4.033 | 3.55 | 3.431 | 3.313 |
| 11 | 2.8 | 3.25 | 3 | 3.3 | 3.2 | 3.5 | 4.1 | 3.69 | 4.03 | 4.96 | 4.2 | 4.546 | 3.946 | 3.63 | 3.841 | 4.029 |
| 12 | 2.85 | 3 | 3.7 | 3.4 | 3.8 | 3.7 | 4 | 3.94 | 3.62 | 6 | 4.963 | 4.823 | 4.033 | 3.78 | 4.114 | 4.424 |
| 13 | 3.6 | 3 | 3.3 | 4.2 | 3.9 | 4.4 | 4.2 | 3.91 | 4.63 | 5.58 | 5.711 | 4.68 | 4.908 | 4.064 | 4 | 5.468 |
| 14 | | | | | | | | | | | | | | | | 5.595 |
| 15 | | | | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | | | | |

| | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 0.439 | | | 0.55 | 0.671 | | | 0.161 | | | | | | | |
| 2 | 0.615 | 0.848 | 0.81 | 0.666 | 1.159 | 0.79 | 0.796 | 0.672 | 0.773 | 0.905 | 0.627 | 0.611 | 0.969 | 0.804 | 0.780 | 0.490 |
| 3 | 0.779 | 1.065 | 1.085 | 1.073 | 1.104 | 1.026 | 0.972 | 1.139 | 1.074 | 1.011 | 1.03 | 0.922 | 1.200 | 0.931 | 1.053 | 0.877 |
| 4 | 1.005 | 1.179 | 1.232 | 1.431 | 1.44 | 1.232 | 1.129 | 1.312 | 1.369 | 1.217 | 1.269 | 1.029 | 1.426 | 1.202 | 1.157 | 1.161 |
| 5 | 1.326 | 1.469 | 1.35 | 1.809 | 1.833 | 1.572 | 1.392 | 1.483 | 1.597 | 1.396 | 1.561 | 1.23 | 1.411 | 1.280 | 1.389 | 1.151 |
| 6 | 1.796 | 1.522 | 1.511 | 1.74 | 2.016 | 1.956 | 1.734 | 1.793 | 1.73 | 1.598 | 1.869 | 1.429 | 1.638 | 1.307 | 1.311 | 1.230 |
| 7 | 2.472 | 1.683 | 1.69 | 2.001 | 2.066 | 1.887 | 2.132 | 2.08 | 1.976 | 1.614 | 2.048 | 1.676 | 2.018 | 1.516 | 1.393 | 1.195 |
| 8 | 3.123 | 1.794 | 1.672 | 2.05 | 2.234 | 1.963 | 2.098 | 2.493 | 2.013 | 1.86 | 2.069 | 1.88 | 2.366 | 1.783 | 1.643 | 1.273 |
| 9 | 4.051 | 2.031 | 1.815 | 2.106 | 2.24 | 2.156 | 2.365 | 2.101 | 2.355 | 2.136 | 2.199 | 2.06 | 2.137 | 2.288 | 1.860 | 1.446 |
| 10 | 3.309 | 2.256 | 1.882 | 2.351 | 2.226 | 2.167 | 2.242 | 2.775 | 2.286 | 2.042 | 2.357 | 2.122 | 2.110 | 2.521 | 2.210 | 1.513 |
| 11 | 4.15 | 2.373 | 2.256 | 2.316 | 2.274 | 2.1 | 2.377 | 2.204 | 2.584 | 2.75 | 2.648 | 2.433 | 2.869 | 2.161 | 2.382 | 1.736 |
| 12 | 4.775 | 2.57 | 2.379 | 2.613 | 2.339 | 1.968 | 2.148 | 2.361 | 2.305 | 3.373 | 2.55 | 2.939 | 2.503 | 3.118 | 2.747 | 1.855 |
| 13 | 5.173 | 2.329 | 2.49 | 2.373 | 2.327 | 2.66 | 2.521 | 2.899 | 2.623 | 3.027 | 3.072 | 3.537 | 2.361 | 2.618 | 2.699 | 2.753 |
| 14 | 5.827 | 3.302 | 2.713 | 3.126 | 2.654 | 2.919 | 2.887 | 4.51 | 2.902 | 3.271 | 4.461 | 3.604 | 5.700 | 3.546 | 1.788 | 4.342 |
| 15 | | 3.767 | 3.135 | 3.204 | 3.421 | 3.218 | 4.777 | 4.306 | 3.095 | 3.49 | | 2.348 | 5.184 | 2.576 | 3.167 | 4.065 |
| 16 | 7.526 | 4.754 | 6.052 | 4.546 | 3.787 | 5.541 | 5.628 | 2.486 | 3.224 | 3.286 | 3.674 | 3.081 | | | | |

Table 12 4X haddock mean numbers per standard tow by stratum from the 1970-2002 summer RV survey

| | trawlable units | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 470 | 71962 | 3.94 | 0.56 | 5.68 | 5.13 | 0.41 | 4.20 | 0.70 | 213.93 | 5.75 | 36.25 | 3.28 | 6.09 | 0.00 | 36.34 | 12.56 | 0.97 |
| 471 | 85080 | 0.00 | 0.00 | 2.47 | 0.00 | 0.00 | 0.55 | 0.00 | 0.44 | 0.46 | 0.55 | 2.92 | 2.66 | 4.89 | 3.89 | 0.46 | 0.00 |
| 472 | 105842 | 13.72 | 37.80 | 15.86 | 12.56 | 28.86 | 49.18 | 35.25 | 14.92 | 10.53 | 32.55 | 248.91 | 192.03 | 141.20 | 39.75 | 49.03 | 73.40 |
| 473 | 22456 | 89.87 | 9.96 | 82.22 | 51.92 | 53.90 | 11.50 | 113.46 | 170.97 | 26.39 | 81.26 | 31.42 | 10.60 | 135.68 | 34.22 | 60.70 | 189.10 |
| 474 | 13643 | 55.73 | 25.61 | 26.96 | 39.50 | 75.43 | 97.01 | 76.85 | 25.00 | 103.56 | 303.43 | 27.18 | 119.46 | 135.37 | 56.27 | 0.00 | 134.50 |
| 475 | 13220 | 78.14 | 53.68 | 21.97 | 57.63 | 105.68 | 27.13 | 137.04 | 36.58 | 61.00 | 77.82 | 71.20 | 46.08 | 48.50 | 53.94 | 254.51 | 100.65 |
| 476 | 125248 | 0.00 | 84.58 | 12.36 | 0.00 | 41.53 | 39.53 | 1.31 | 1055.25 | 53.78 | 0.00 | 20.10 | 14.64 | 5.50 | 62.34 | 6.78 | 369.87 |
| 477 | 104401 | 45.40 | 34.13 | 24.52 | 31.91 | 132.00 | 25.24 | 66.84 | 31.07 | 45.54 | 44.47 | 35.92 | 53.20 | 84.15 | 86.96 | 150.81 | 92.13 |
| 478 | 19745 | 1.75 | 1.75 | 0.70 | 0.56 | 2.52 | 3.21 | 10.50 | 4.68 | 6.15 | 2.52 | 1.75 | 0.67 | 2.94 | 17.14 | 16.73 | 20.42 |
| 480 | 55506 | 100.65 | 242.10 | 98.74 | 132.80 | 264.49 | 176.52 | 64.13 | 631.56 | 192.55 | 88.73 | 224.06 | 160.81 | 73.74 | 93.29 | 172.05 | 117.45 |
| 481 | 156890 | 63.26 | 30.69 | 31.69 | 161.36 | 273.08 | 49.72 | 56.51 | 30.61 | 72.88 | 65.20 | 169.64 | 35.11 | 170.30 | 41.82 | 70.77 | 16.66 |
| 482 | 56301 | 2.33 | 3.32 | 0.00 | 0.00 | 5.63 | 3.06 | 4.69 | 9.75 | 8.40 | 20.64 | 14.75 | 9.92 | 23.33 | 8.56 | 20.90 | 1.46 |
| 483 | 45082 | 2.53 | 0.00 | 4.06 | 0.00 | 1.85 | 2.10 | 30.33 | 9.96 | 1.75 | 11.06 | 23.50 | 32.23 | 70.04 | 5.66 | 33.40 | 14.58 |
| 484 | 191855 | 0.00 | 0.53 | 0.00 | 0.37 | 0.35 | 0.39 | 6.11 | 0.41 | 0.58 | 14.67 | 2.33 | 1.87 | 6.04 | 1.28 | 4.12 | 2.94 |
| 485 | 134061 | 52.16 | 11.78 | 3.11 | 31.92 | 9.29 | 12.00 | 14.77 | 34.48 | 13.88 | 10.87 | 65.92 | 15.01 | 24.85 | 11.29 | 26.44 | 50.44 |
| 490 | 50930 | 30.43 | 56.87 | 0.53 | 70.77 | 324.46 | 48.12 | 109.15 | 189.51 | 63.48 | 364.72 | 311.15 | 1479.70 | 485.53 | 234.97 | 773.65 | 160.56 |
| 491 | 58217 | 4.16 | 0.00 | 11.39 | 3.82 | 21.05 | 3.01 | 2.56 | 21.30 | 11.52 | 5.21 | 16.37 | 15.48 | 30.46 | 32.01 | 29.26 | 16.34 |
| 492 | 92029 | 1.22 | 21.00 | 6.74 | 4.81 | 19.83 | 7.78 | 25.55 | 16.21 | 7.66 | 26.29 | 5.64 | 21.31 | 103.64 | 16.56 | 1.24 | 5.04 |
| 493 | 45167 | 2.42 | 0.66 | 1.56 | 4.37 | 0.74 | 6.15 | 4.42 | 6.56 | 10.57 | 0.41 | 1.58 | 3.09 | 1.65 | 0.39 | 36.04 | 2.31 |
| 494 | 35337 | 0.00 | 1.40 | 5.75 | 7.45 | 16.16 | 6.03 | 3.49 | 16.57 | 4.86 | 17.29 | 1.85 | 3.21 | 5.04 | 0.00 | 5.56 | 3.50 |
| 495 | 49489 | 16.80 | 13.56 | 9.33 | 4.00 | 20.19 | 1.73 | 4.87 | 33.92 | 48.00 | 31.46 | 6.75 | 6.68 | 38.59 | 14.64 | 3.09 | 5.22 |
| 470-481 | 781993 | 33.23 | 48.42 | 24.84 | 56.33 | 107.20 | 42.24 | 37.20 | 259.13 | 49.33 | 46.84 | 95.82 | 59.54 | 60.09 | 49.45 | 63.65 | 103.70 |
| 482-495 | 790468 | 12.85 | 9.58 | 3.35 | 11.75 | 29.21 | 7.55 | 17.16 | 26.51 | 13.19 | 39.61 | 37.16 | 105.72 | 58.54 | 23.75 | 63.96 | 27.95 |
| Total | 1572461 | 22.96 | 28.90 | 14.09 | 33.91 | 67.99 | 24.80 | 27.12 | 142.49 | 31.16 | 43.20 | 66.34 | 82.75 | 59.26 | 36.55 | 63.81 | 65.62 |

| | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 1970-2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 470 | 6.81 | 6.46 | 3.19 | 1.54 | 0.00 | 0.67 | 0.49 | 0.00 | 2.11 | 5.66 | 16.49 | 6.09 | 0.97 | 2.06 | 99.64 | 3.44 | 18.06 |
| 471 | 2.57 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 1.01 | 0.00 | 1.01 | 5.34 | 0.00 | 182.22 | 0.50 | 6.46 |
| 472 | 26.21 | 34.73 | 47.23 | 17.47 | 19.11 | 7.89 | 7.32 | 14.77 | 42.50 | 74.95 | 30.98 | 7.25 | 194.46 | 41.45 | 78.14 | 27.93 | 52.82 |
| 473 | 60.29 | 12.01 | 12.32 | 41.51 | 92.36 | 5.63 | 0.46 | 47.42 | 210.78 | 352.79 | 101.04 | 199.65 | 85.43 | 66.13 | 75.46 | 155.32 | 86.86 |
| 474 | 3.15 | 1.54 | 1.80 | 31.11 | 6.32 | 6.69 | 6.26 | 6.16 | 8.15 | 41.32 | 107.22 | 92.63 | 58.35 | 126.46 | 15.56 | 574.19 | 74.32 |
| 475 | 14.13 | 13.90 | 22.10 | 54.47 | 22.48 | 16.04 | 8.75 | 125.37 | 164.81 | 175.06 | 46.38 | 47.16 | 65.12 | 267.61 | 153.13 | 171.72 | 84.23 |
| 476 | 25.03 | 9.10 | 9.21 | 5.30 | 8.51 | 11.67 | 2.83 | 14.62 | 51.60 | 52.17 | 72.14 | 25.26 | 19.05 | 32.62 | 175.65 | 133.00 | 74.03 |
| 477 | 43.69 | 59.46 | 42.02 | 24.37 | 36.58 | 39.23 | 12.64 | 56.47 | 248.00 | 86.51 | 60.13 | 120.74 | 213.79 | 279.37 | 304.24 | 141.85 | 87.47 |
| 478 | 25.39 | 11.32 | 0.00 | 13.63 | 0.00 | 4.68 | 3.40 | 14.39 | 5.30 | 22.14 | 5.90 | 3.09 | 6.14 | 35.14 | 16.65 | 53.90 | 9.91 |
| 480 | 52.76 | 84.95 | 175.59 | 251.54 | 316.69 | 200.96 | 71.76 | 173.09 | 274.90 | 226.30 | 341.60 | 322.51 | 1022.21 | 964.38 | 448.81 | 298.85 | 247.92 |
| 481 | 31.93 | 25.72 | 29.26 | 18.03 | 40.43 | 25.32 | 41.43 | 41.01 | 145.58 | 102.30 | 71.66 | 56.67 | 274.05 | 130.46 | 326.67 | 176.67 | 93.69 |
| 482 | 31.53 | 22.73 | 16.19 | 39.56 | 20.86 | 1.50 | 7.26 | 19.23 | 16.65 | 136.92 | 25.17 | 10.62 | 19.44 | 48.93 | 6.48 | 24.63 | 18.03 |
| 483 | 11.46 | 20.59 | 1.54 | 36.84 | 41.78 | 4.03 | 3.63 | 0.50 | 3.54 | 1.96 | 17.23 | 4.46 | 4.22 | 4.97 | 13.76 | 15.99 | 13.42 |
| 484 | 0.00 | 1.37 | 0.97 | 0.97 | 0.00 | 0.00 | 0.70 | 0.65 | 3.03 | 5.17 | 2.91 | 3.01 | 3.73 | 6.55 | 23.14 | 6.04 | 3.12 |
| 485 | 2.97 | 9.58 | 1.86 | 13.13 | 87.06 | 20.51 | 6.40 | 1.69 | 78.02 | 94.92 | 4.35 | 34.48 | 84.62 | 219.97 | 10.63 | 98.90 | 37.13 |
| 490 | 44.56 | 126.41 | 126.52 | 174.02 | 79.27 | 104.55 | 16.53 | 412.74 | 541.72 | 206.00 | 267.66 | 139.15 | 62.71 | 137.65 | 219.26 | 87.63 | 231.51 |
| 491 | 1.03 | 0.26 | 0.00 | 0.67 | 1.30 | 3.56 | 4.80 | 22.25 | 63.99 | 9.26 | 44.53 | 10.15 | 38.49 | 64.99 | 132.13 | 50.37 | 20.42 |
| 492 | 2.63 | 5.33 | 0.31 | 0.00 | 0.39 | 6.21 | 0.00 | 7.00 | 8.02 | 4.69 | 37.18 | 67.20 | 7.05 | 4.99 | 6.61 | 13.26 | 14.16 |
| 493 | 13.65 | 0.00 | 0.00 | 0.00 | 0.00 | 1.56 | 0.00 | 0.00 | 1.12 | 0.62 | 24.29 | 1.63 | 5.90 | 14.70 | 25.74 | 4.97 | 6.45 |
| 494 | 0.00 | 0.70 | 0.00 | 0.00 | 2.92 | 0.58 | 0.00 | 6.00 | 25.43 | 300.70 | 0.00 | 17.83 | 29.51 | 139.30 | 7.41 | 36.51 | 20.96 |
| 495 | 0.00 | 0.98 | 0.00 | 18.05 | 0.00 | 0.00 | 0.00 | 4.93 | 55.27 | 16.99 | 46.84 | 21.23 | 61.06 | 52.01 | 7.41 | 60.04 | 19.03 |
| 470-481 | 28.12 | 26.89 | 32.96 | 31.14 | 42.94 | 25.36 | 17.11 | 36.53 | 105.6 | 81.94 | 69.99 | 65.11 | 191.58 | 152.65 | 212.82 | 120.28 | 75.32 |
| 482-495 | 8.55 | 14.58 | 11.05 | 21.37 | 24.83 | 11.77 | 4.17 | 32.06 | 60.91 | 67.92 | 33.6 | 26.38 | 30.66 | 69.7 | 36.04 | 39.77 | 30.11 |
| Total | 16.26 | 20.7 | 21.95 | 26.23 | 33.83 | 20.02 | 10.61 | 34.28 | 83.14 | 74.69 | 51.7 | 45.64 | 110.76 | 111.05 | 123.95 | 79.86 | 52.62 |

Table 13. 4X haddock mean numbers at age per standard tow from the 1970-2002 summer RV survey

| | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.47 | 0.03 | 0.54 | 0.14 | 0.32 | 0.27 | 0.00 | 0.14 |
| 1 | 5.21 | 0.10 | 4.72 | 5.79 | 10.31 | 6.02 | 4.98 | 5.77 | 5.54 | 1.84 | 19.84 | 32.96 | 11.70 | 6.11 | 3.75 | 6.31 | 3.44 |
| 2 | 4.17 | 10.08 | 0.21 | 20.57 | 20.71 | 3.24 | 5.86 | 36.36 | 4.73 | 12.40 | 6.32 | 25.43 | 25.10 | 4.04 | 21.44 | 8.68 | 8.54 |
| 3 | 1.23 | 4.38 | 3.04 | 0.66 | 29.86 | 4.83 | 3.77 | 56.86 | 10.95 | 7.46 | 13.92 | 6.15 | 11.91 | 12.89 | 10.99 | 20.81 | 6.75 |
| 4 | 2.31 | 1.94 | 1.38 | 2.89 | 0.91 | 7.17 | 3.94 | 16.13 | 3.74 | 9.45 | 7.16 | 8.43 | 4.73 | 5.70 | 16.56 | 9.54 | 13.55 |
| 5 | 0.93 | 2.70 | 0.81 | 1.36 | 3.74 | 0.37 | 6.65 | 15.62 | 1.55 | 4.78 | 11.12 | 3.43 | 7.69 | 3.36 | 5.20 | 13.15 | 5.30 |
| 6 | 2.14 | 1.28 | 0.90 | 0.48 | 0.84 | 1.62 | 0.56 | 8.61 | 2.98 | 2.00 | 4.29 | 3.80 | 3.14 | 2.12 | 2.66 | 3.38 | 5.66 |
| 7 | 5.51 | 1.99 | 0.59 | 0.70 | 0.49 | 0.41 | 0.72 | 1.17 | 1.18 | 2.99 | 1.55 | 1.21 | 3.43 | 0.87 | 1.28 | 1.68 | 2.02 |
| 8 | 0.78 | 5.49 | 0.92 | 0.52 | 0.59 | 0.31 | 0.13 | 1.41 | 0.08 | 1.29 | 1.17 | 0.16 | 0.59 | 0.31 | 0.54 | 1.06 | 1.04 |
| 9 | 0.31 | 0.71 | 1.44 | 0.34 | 0.32 | 0.13 | 0.07 | 0.16 | 0.00 | 0.22 | 0.56 | 0.30 | 0.38 | 0.29 | 0.36 | 0.59 | 0.59 |
| 10 | 0.30 | 0.08 | 0.05 | 0.57 | 0.23 | 0.11 | 0.02 | 0.14 | 0.00 | 0.10 | 0.23 | 0.18 | 0.21 | 0.21 | 0.08 | 0.22 | 0.34 |
| 11 | 0.07 | 0.04 | 0.01 | 0.02 | 0.35 | 0.34 | 0.01 | 0.02 | 0.04 | 0.00 | 0.03 | 0.08 | 0.14 | 0.17 | 0.03 | 0.06 | 0.06 |
| 12 | 0.02 | 0.10 | 0.00 | 0.00 | 0.00 | 0.26 | 0.14 | 0.15 | 0.03 | 0.00 | 0.00 | 0.04 | 0.00 | 0.05 | 0.03 | 0.03 | 0.10 |
| 13 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.10 | 0.08 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.04 | 0.03 | 0.06 |
| 14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.28 | 0.09 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 |
| 15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| unknown | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.16 | 0.01 | 0.18 | 0.03 | 0.06 | 0.05 | 0.11 | 0.05 | 0.03 | 0.03 | 0.10 |
| 4X total | 22.98 | 28.89 | 14.09 | 33.91 | 68.35 | 24.50 | 27.12 | 142.59 | 31.16 | 43.21 | 66.31 | 82.76 | 69.27 | 36.54 | 63.25 | 65.60 | 47.69 |
| SS total | 33.23 | 48.43 | 24.94 | 56.32 | 107.20 | 42.24 | 37.20 | 259.73 | 49.33 | 46.83 | 95.83 | 59.54 | 80.09 | 49.49 | 62.54 | 103.70 | 83.72 |
| BoF total | 12.85 | 9.57 | 3.35 | 11.75 | 29.21 | 7.55 | 17.15 | 26.51 | 13.19 | 39.61 | 37.17 | 105.72 | 58.54 | 23.75 | 63.96 | 27.95 | 12.30 |

| | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 1970-01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.00 | 0.06 | 0.00 | 0.17 | 0.00 | 0.00 | 0.00 | 2.55 | 0.18 | 2.00 | 0.12 | 1.63 | 24.78 | 24.79 | 4.32 | 0.01 | 1.95 |
| 1 | 1.20 | 6.44 | 5.39 | 0.07 | 3.86 | 2.81 | 4.17 | 19.09 | 41.81 | 4.53 | 9.02 | 8.98 | 32.51 | 24.61 | 27.74 | 3.81 | 10.21 |
| 2 | 1.38 | 1.92 | 8.79 | 9.66 | 1.24 | 2.24 | 0.95 | 5.34 | 22.41 | 24.17 | 5.30 | 6.94 | 18.43 | 40.10 | 26.72 | 15.27 | 12.36 |
| 3 | 2.45 | 0.91 | 1.76 | 8.60 | 11.36 | 0.88 | 1.57 | 1.98 | 10.63 | 22.71 | 19.25 | 4.26 | 8.71 | 6.19 | 37.22 | 20.80 | 10.77 |
| 4 | 3.03 | 1.90 | 0.62 | 1.58 | 10.37 | 6.92 | 0.60 | 1.78 | 3.77 | 11.56 | 11.62 | 12.52 | 5.84 | 4.29 | 10.91 | 23.00 | 6.35 |
| 5 | 3.67 | 2.65 | 1.66 | 1.28 | 2.18 | 4.92 | 1.72 | 0.35 | 1.71 | 4.67 | 3.60 | 5.74 | 9.92 | 3.48 | 4.15 | 5.48 | 4.39 |
| 6 | 2.55 | 2.81 | 0.71 | 1.42 | 1.20 | 0.94 | 1.04 | 1.75 | 0.70 | 1.54 | 1.50 | 1.72 | 5.53 | 4.81 | 1.98 | 2.87 | 2.40 |
| 7 | 1.86 | 1.34 | 1.47 | 1.29 | 1.06 | 0.35 | 0.17 | 1.02 | 1.43 | 1.07 | 0.55 | 1.39 | 2.72 | 1.71 | 5.06 | 2.09 | 1.57 |
| 8 | 0.81 | 1.05 | 0.52 | 1.08 | 0.91 | 0.36 | 0.13 | 0.14 | 0.37 | 1.50 | 0.17 | 0.91 | 1.05 | 0.68 | 1.95 | 3.16 | 0.88 |
| 9 | 0.24 | 0.65 | 0.44 | 0.45 | 0.67 | 0.26 | 0.05 | 0.05 | 0.09 | 0.37 | 0.28 | 0.25 | 0.79 | 0.30 | 1.08 | 1.71 | 0.40 |
| 10 | 0.29 | 0.36 | 0.13 | 0.37 | 0.80 | 0.19 | 0.04 | 0.08 | 0.00 | 0.30 | 0.18 | 0.16 | 0.17 | 0.06 | 0.73 | 0.91 | 0.22 |
| 11 | 0.07 | 0.12 | 0.10 | 0.18 | 0.08 | 0.04 | 0.09 | 0.01 | 0.00 | 0.12 | 0.02 | 0.11 | 0.17 | 0.02 | 0.08 | 0.62 | 0.08 |
| 12 | 0.01 | 0.01 | 0.08 | 0.08 | 0.08 | 0.02 | 0.02 | 0.05 | 0.02 | 0.02 | 0.01 | 0.01 | 0.11 | 0.01 | 0.00 | 0.03 | 0.05 |
| 13 | 0.00 | 0.00 | 0.00 | 0.05 | 0.02 | 0.00 | 0.03 | 0.09 | 0.00 | 0.07 | 0.00 | 0.00 | 0.04 | 0.00 | 0.03 | 0.04 | 0.02 |
| 14 | 0.03 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.02 |
| 15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| 16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| unknown | 0.70 | 0.48 | 0.05 | 0.02 | 0.00 | 0.05 | 0.02 | 0.00 | 0.02 | 0.27 | 0.04 | 0.01 | 0.00 | 0.01 | 0.00 | 0.01 | 0.08 |
| 4X total | 18.28 | 20.70 | 21.93 | 26.23 | 33.83 | 20.02 | 10.51 | 34.28 | 83.14 | 74.90 | 51.69 | 45.64 | 110.79 | 111.06 | 123.97 | 79.81 | 51.74 |
| SS total | 26.12 | 26.89 | 32.96 | 31.14 | 42.94 | 28.36 | 17.11 | 36.52 | 105.60 | 81.94 | 69.99 | 65.11 | 191.56 | 152.85 | 212.82 | 120.27 | 73.88 |
| BoF total | 8.55 | 14.58 | 11.05 | 21.37 | 24.83 | 11.77 | 4.17 | 32.06 | 60.91 | 67.92 | 33.60 | 26.38 | 30.88 | 69.70 | 36.04 | 39.78 | 29.81 |

Table 14. 4X Haddock summer RV survey strata 470-495 - mean length-at-age (cm)

| | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | 8.5 | | 7.3 | 6.5 | 8.3 | 6.5 | 7.8 | 8.2 | | 6.5 |
| 1 | 21.0 | 20.6 | 19.9 | 21.3 | 21.0 | 21.9 | 21.0 | 21.9 | 19.0 | 19.9 | 20.0 | 19.9 | 17.9 | 18.7 | 20.5 | 19.5 | 19.5 |
| 2 | 33.6 | 29.3 | 26.9 | 30.2 | 31.1 | 32.6 | 32.3 | 35.1 | 33.8 | 32.0 | 33.3 | 32.8 | 26.9 | 28.2 | 29.4 | 30.8 | 30.1 |
| 3 | 41.1 | 41.6 | 39.3 | 35.7 | 40.0 | 41.4 | 40.0 | 42.4 | 43.0 | 41.0 | 40.8 | 41.4 | 38.8 | 37.1 | 34.5 | 36.6 | 38.2 |
| 4 | 45.7 | 47.0 | 48.7 | 49.6 | 45.3 | 48.5 | 48.4 | 48.1 | 50.2 | 49.6 | 49.3 | 47.8 | 48.8 | 46.7 | 42.2 | 41.2 | 41.0 |
| 5 | 49.9 | 51.3 | 52.8 | 54.8 | 54.4 | 54.2 | 53.1 | 54.1 | 54.7 | 54.4 | 54.8 | 55.3 | 53.5 | 53.5 | 49.1 | 45.7 | 45.4 |
| 6 | 52.0 | 53.1 | 56.0 | 59.5 | 59.3 | 59.3 | 58.1 | 56.6 | 57.7 | 60.2 | 58.1 | 59.9 | 59.6 | 56.8 | 55.8 | 50.7 | 48.3 |
| 7 | 56.2 | 54.9 | 56.5 | 60.1 | 61.3 | 63.6 | 62.8 | 63.6 | 61.2 | 62.8 | 61.4 | 62.8 | 63.9 | 61.4 | 58.9 | 57.5 | 51.2 |
| 8 | 59.6 | 58.7 | 60.2 | 60.7 | 62.7 | 64.7 | 61.3 | 65.2 | 66.2 | 65.6 | 63.2 | 64.3 | 67.7 | 63.7 | 61.4 | 58.1 | 54.2 |
| 9 | 60.5 | 63.0 | 63.1 | 63.0 | 63.0 | 65.6 | 65.7 | 69.8 | | 71.6 | 67.1 | 67.5 | 68.7 | 64.8 | 65.5 | 57.8 | 59.8 |
| 10 | 65.1 | 70.5 | 69.1 | 63.9 | 63.6 | 67.5 | 66.5 | 65.2 | | 69.1 | 67.5 | 72.8 | 74.6 | 66.9 | 69.4 | 62.9 | 60.1 |
| 11 | 68.2 | 69.4 | 68.5 | 67.7 | 68.0 | 67.0 | 72.5 | 66.5 | 62.5 | | 70.5 | 72.3 | 74.9 | 67.6 | 70.5 | 62.7 | 64.8 |
| 12 | 60.5 | 72.9 | 76.5 | | | 66.8 | 66.9 | 69.0 | 68.5 | | | 74.5 | | 70.8 | 72.5 | 66.5 | 65.5 |
| 13 | | | 78.5 | 70.5 | | | 69.7 | 72.9 | 72.5 | | | | | 75.0 | 66.5 | 66.5 | 61.1 |
| 14 | | | | | | | | 69.8 | 73.2 | 72.5 | | | | | | 68.7 | |
| 15 | | | | | | | | | 70.3 | 72.9 | | | | | | | |
| 16 | | | | | | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | | | | | | |

| | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 1970-01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | 6.5 | 10.5 | 8.5 | | | | 8.7 | 7.5 | 9.7 | 8.4 | 8.7 | 9.7 | 10.0 | 9.0 | 6.5 | 8.3 |
| 1 | 21.0 | 20.9 | 20.4 | 21.5 | 20.7 | 19.4 | 22.1 | 23.8 | 18.6 | 17.6 | 22.1 | 18.7 | 21.7 | 22.3 | 20.6 | 19.9 | 20.5 |
| 2 | 31.9 | 34.6 | 32.0 | 33.1 | 37.5 | 30.8 | 32.7 | 34.2 | 32.6 | 27.4 | 28.1 | 29.5 | 25.8 | 33.7 | 28.7 | 27.6 | 31.3 |
| 3 | 37.5 | 40.1 | 40.7 | 41.6 | 42.7 | 39.3 | 41.8 | 42.7 | 42.8 | 39.9 | 34.2 | 34.2 | 37.1 | 37.9 | 37.2 | 34.0 | 39.5 |
| 4 | 44.1 | 44.9 | 43.4 | 48.8 | 49.7 | 47.2 | 47.3 | 48.9 | 48.6 | 48.6 | 42.1 | 38.9 | 38.6 | 43.8 | 39.4 | 39.8 | 46.0 |
| 5 | 47.1 | 49.6 | 49.0 | 53.8 | 52.1 | 53.4 | 51.5 | 49.9 | 52.5 | 51.7 | 48.4 | 46.7 | 42.5 | 42.7 | 45.1 | 41.4 | 50.8 |
| 6 | 47.2 | 49.1 | 52.0 | 54.7 | 56.3 | 57.3 | 55.9 | 53.2 | 53.6 | 54.8 | 50.3 | 51.7 | 45.1 | 45.6 | 45.4 | 45.5 | 54.2 |
| 7 | 51.3 | 51.6 | 52.0 | 57.2 | 58.4 | 59.1 | 57.4 | 56.0 | 56.3 | 56.8 | 54.0 | 54.6 | 47.7 | 50.0 | 46.7 | 46.5 | 57.2 |
| 8 | 53.6 | 52.9 | 52.1 | 57.7 | 57.9 | 54.7 | 56.6 | 60.4 | 59.7 | 57.6 | 57.9 | 58.4 | 49.8 | 52.0 | 49.1 | 46.6 | 59.0 |
| 9 | 58.0 | 54.8 | 52.7 | 59.8 | 55.8 | 55.2 | 51.0 | 53.3 | 65.6 | 62.5 | 56.5 | 56.4 | 50.0 | 56.4 | 51.6 | 48.9 | 60.5 |
| 10 | 56.8 | 54.4 | 56.0 | 52.3 | 53.9 | 61.1 | 58.0 | 54.5 | | 60.5 | 54.0 | 54.5 | 55.3 | 61.5 | 46.9 | 49.1 | 61.8 |
| 11 | 61.7 | 59.2 | 60.9 | 60.7 | 66.3 | 64.2 | 58.3 | 58.5 | | 58.5 | 60.4 | 60.4 | 55.6 | 56.5 | 53.9 | 41.6 | 64.3 |
| 12 | 76.5 | 62.5 | 50.9 | 58.1 | 61.0 | 62.5 | 56.5 | 51.5 | 54.5 | 59.6 | 62.5 | 54.5 | 55.1 | 62.5 | | 59.6 | 63.8 |
| 13 | | | | 68.0 | 70.5 | 68.5 | 56.4 | 57.8 | | 69.3 | | | 51.4 | | 52.5 | 61.1 | 66.3 |
| 14 | 65.9 | | 66.5 | 66.5 | 68.5 | | 74.5 | | | | | | 68.5 | | 74.5 | | 69.9 |
| 15 | | | | | | | | | | | | | | | | | 71.6 |
| 16 | | | | | | | | | | | 58.5 | | | | | | 58.5 |
| 17 | | | | | 64.5 | | | | | | | | | | | | 64.5 |

Table 15. 4X Haddock summer RV survey strata 470-495 - mean weight-at-age (kg)

| | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | | | | | |
| 1 | 0.080 | 0.102 | 0.078 | 0.092 | 0.087 | 0.102 | 0.090 | 0.103 | 0.067 | 0.082 | 0.073 | 0.075 | 0.047 | 0.040 | 0.083 | 0.073 | 0.053 |
| 2 | 0.392 | 0.248 | 0.203 | 0.296 | 0.309 | 0.369 | 0.367 | 0.463 | 0.413 | 0.345 | 0.440 | 0.401 | 0.223 | 0.241 | 0.290 | 0.331 | 0.285 |
| 3 | 0.761 | 0.762 | 0.661 | 0.510 | 0.708 | 0.759 | 0.695 | 0.838 | 0.900 | 0.781 | 0.793 | 0.864 | 0.678 | 0.550 | 0.465 | 0.549 | 0.603 |
| 4 | 1.078 | 1.083 | 1.303 | 1.347 | 1.012 | 1.266 | 1.160 | 1.258 | 1.465 | 1.369 | 1.309 | 1.201 | 1.310 | 1.103 | 0.836 | 0.728 | 0.776 |
| 5 | 1.384 | 1.424 | 1.633 | 1.616 | 1.716 | 1.800 | 1.523 | 1.771 | 1.951 | 1.757 | 1.752 | 1.864 | 1.697 | 1.586 | 1.273 | 1.010 | 1.017 |
| 6 | 1.607 | 1.618 | 1.991 | 2.374 | 2.218 | 2.271 | 1.926 | 2.009 | 2.260 | 2.383 | 2.111 | 2.312 | 2.325 | 1.886 | 1.647 | 1.380 | 1.178 |
| 7 | 2.033 | 1.721 | 2.145 | 2.396 | 2.516 | 2.828 | 2.411 | 2.870 | 2.640 | 2.709 | 2.496 | 2.761 | 2.869 | 2.383 | 2.073 | 2.023 | 1.431 |
| 8 | 2.337 | 2.181 | 2.501 | 2.464 | 2.679 | 3.013 | 2.384 | 2.917 | 3.422 | 3.368 | 2.712 | 3.109 | 3.341 | 2.665 | 2.447 | 1.977 | 1.693 |
| 9 | 2.384 | 2.590 | 2.897 | 2.717 | 2.784 | 3.251 | 2.685 | 4.021 | | 4.034 | 3.451 | 3.308 | 3.446 | 2.818 | 2.830 | 1.936 | 2.173 |
| 10 | 2.951 | 4.073 | 3.966 | 2.885 | 2.817 | 3.169 | 2.600 | 2.972 | | 3.477 | 3.319 | 3.970 | 4.212 | 3.176 | 3.769 | 2.483 | 2.200 |
| 11 | 3.631 | 3.516 | 3.700 | 3.386 | 3.408 | 3.314 | 3.500 | 3.500 | 2.600 | | 3.400 | 3.811 | 4.468 | 3.146 | 2.350 | 2.635 | 2.803 |
| 12 | 2.225 | 4.738 | 4.600 | | | 3.326 | 3.056 | 3.531 | 4.200 | | | 4.000 | | 3.690 | 3.500 | 3.200 | 2.836 |
| 13 | | | 6.200 | 4.000 | | | 3.374 | 3.631 | 3.900 | | | | | 4.366 | 2.300 | 3.100 | 2.119 |
| 14 | | | | | | | | 3.693 | 4.195 | 3.600 | | | | | | 3.036 | |
| 15 | | | | | | | | | 4.237 | 4.721 | | | | | | | |
| 16 | | | | | | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | | | | | | |

| | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 1970-01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | 0.007 | 0.005 | 0.010 | 0.005 | 0.007 | 0.009 | 0.010 | 0.007 | 0.003 | 0.006 |
| 1 | 0.093 | 0.092 | 0.089 | 0.109 | 0.083 | 0.082 | 0.098 | 0.139 | 0.063 | 0.053 | 0.114 | 0.065 | 0.104 | 0.108 | 0.087 | 0.078 | 0.085 |
| 2 | 0.342 | 0.520 | 0.356 | 0.424 | 0.600 | 0.307 | 0.366 | 0.423 | 0.353 | 0.210 | 0.231 | 0.261 | 0.188 | 0.393 | 0.235 | 0.209 | 0.338 |
| 3 | 0.561 | 0.689 | 0.747 | 0.819 | 0.839 | 0.624 | 0.770 | 0.865 | 0.829 | 0.680 | 0.428 | 0.409 | 0.540 | 0.569 | 0.542 | 0.396 | 0.682 |
| 4 | 0.968 | 0.987 | 0.911 | 1.338 | 1.331 | 1.141 | 1.109 | 1.234 | 1.157 | 1.210 | 0.793 | 0.821 | 0.606 | 0.886 | 0.642 | 0.635 | 1.079 |
| 5 | 1.154 | 1.348 | 1.292 | 1.690 | 1.503 | 1.666 | 1.394 | 1.341 | 1.436 | 1.450 | 1.187 | 1.069 | 0.820 | 0.802 | 0.925 | 0.711 | 1.439 |
| 6 | 1.139 | 1.384 | 1.510 | 1.879 | 2.083 | 2.010 | 1.777 | 1.657 | 1.536 | 1.780 | 1.392 | 1.448 | 0.966 | 1.013 | 0.933 | 0.915 | 1.756 |
| 7 | 1.436 | 1.654 | 1.543 | 2.132 | 2.064 | 2.299 | 1.941 | 1.926 | 1.793 | 1.878 | 1.648 | 1.790 | 1.171 | 1.332 | 1.040 | 0.980 | 2.061 |
| 8 | 1.660 | 1.645 | 1.612 | 2.187 | 2.123 | 1.761 | 1.859 | 2.319 | 2.197 | 1.898 | 1.902 | 2.136 | 1.314 | 1.574 | 1.211 | 0.993 | 2.269 |
| 9 | 2.090 | 1.989 | 1.555 | 2.531 | 2.005 | 2.004 | 1.396 | 1.567 | 2.648 | 2.503 | 1.895 | 2.024 | 1.373 | 1.991 | 1.424 | 1.147 | 2.462 |
| 10 | 1.816 | 1.903 | 1.799 | 1.644 | 1.679 | 2.537 | 2.226 | 1.705 | | 2.454 | 1.535 | 1.581 | 1.890 | 2.458 | 1.143 | 1.167 | 2.614 |
| 11 | 2.328 | 2.203 | 2.310 | 2.450 | 3.511 | 2.786 | 2.191 | 2.195 | | 2.233 | 2.045 | 2.171 | 1.809 | 1.858 | 1.644 | 0.905 | 2.830 |
| 12 | 6.000 | 2.900 | 1.310 | 2.479 | 2.564 | 2.760 | 1.995 | 1.274 | 1.510 | 2.019 | 1.358 | 1.465 | 1.642 | 2.200 | | 1.887 | 2.861 |
| 13 | | | | 3.513 | 3.555 | 3.500 | 1.682 | 2.179 | | 3.879 | | | 1.347 | | 1.450 | 2.430 | 3.182 |
| 14 | 2.870 | | 2.400 | 3.300 | 3.400 | | 4.540 | | | | | | 3.260 | | 3.810 | | 3.464 |
| 15 | | | | | | | | | | | | | | | | | 4.479 |
| 16 | | | | | | | | | | | 2.054 | | | | | | 2.054 |
| 17 | | | | | 2.945 | | | | | | | | | | | | 2.945 |

Table 16. 4X haddock mean number at age per tow, mean number per tow and mean weight per tow from the ITQ survey.

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | AVG |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.5 | 0.0 | 0.3 | 3.6 | 5.4 | 0.6 | 0.0 | 1.5 |
| 1 | 6.9 | 14.7 | 14.9 | 98.8 | 75.7 | 58.9 | 17.3 | 41.0 |
| 2 | 41.3 | 9.5 | 29.3 | 39.7 | 75.7 | 54.5 | 29.3 | 39.9 |
| 3 | 25.1 | 33.1 | 8.3 | 18.2 | 12.0 | 56.5 | 30.4 | 26.2 |
| 4 | 9.0 | 19.4 | 21.5 | 7.1 | 8.5 | 13.5 | 29.9 | 15.6 |
| 5 | 3.5 | 5.0 | 8.0 | 11.1 | 7.2 | 5.0 | 6.5 | 6.6 |
| 6 | 0.9 | 1.6 | 1.2 | 4.6 | 8.1 | 2.1 | 3.0 | 3.1 |
| 7 | 0.7 | 0.6 | 0.8 | 2.1 | 2.6 | 5.3 | 2.2 | 2.0 |
| 8 | 0.8 | 0.2 | 0.4 | 0.6 | 1.0 | 1.9 | 3.0 | 1.1 |
| 9 | 0.2 | 0.3 | 0.2 | 0.5 | 0.3 | 1.0 | 1.6 | 0.6 |
| 10 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.7 | 0.9 | 0.3 |
| 11 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.8 | 0.2 |
| 12 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| 13 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| unk | 0.2 | 0.1 | 0.3 | 0.5 | 2.1 | 0.6 | 0.5 | 0.6 |
| total | 89.3 | 84.7 | 85.5 | 187.1 | 198.7 | 200.7 | 125.4 | 138.8 |
| | | | | | | | | |
| N sets | 173 | 177 | 190 | 185 | 188 | 187 | 183 | |
| Number per tow | 89.2 | 84.7 | 85.5 | 187.3 | 195.3 | 201.5 | 125.6 | 138.4 |
| Weight per tow | 44.2 | 47.9 | 40.2 | 53.9 | 65.5 | 77.5 | 54.2 | 54.8 |

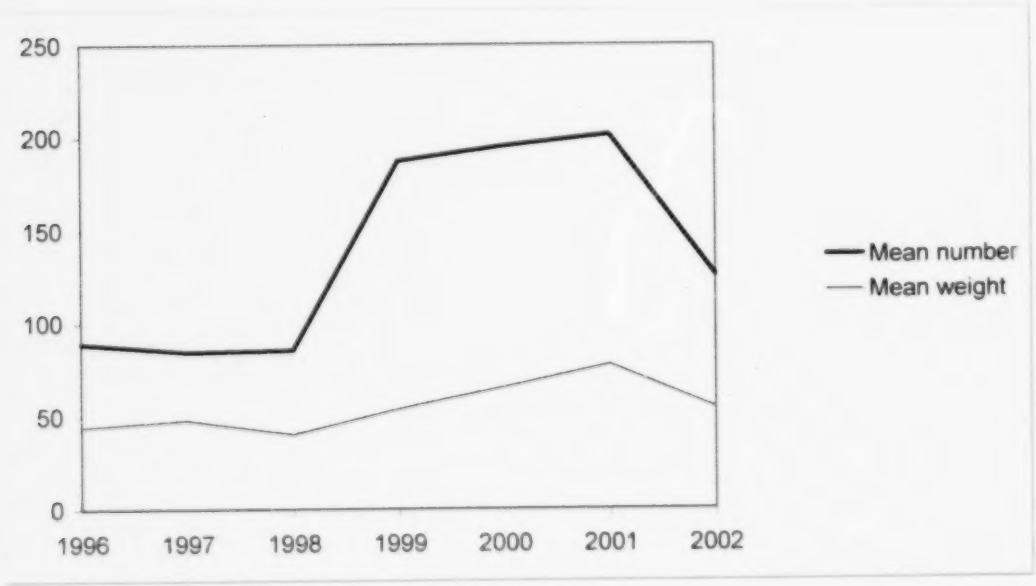


Table 17 SPA results - Residuals

| Age | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 0.01 | 0.30 | -2.16 | 0.43 | 0.46 | -0.74 | -0.91 | 0.85 | -0.71 | -0.04 |
| 3 | -0.60 | 0.26 | -0.70 | -0.97 | 0.98 | -0.85 | -0.43 | 1.46 | -0.25 | -0.19 |
| 4 | -0.36 | 0.14 | -0.47 | -0.40 | -0.49 | -0.08 | -0.74 | 1.30 | -0.89 | -0.06 |
| 5 | -0.37 | 0.17 | -0.44 | 0.02 | 0.22 | -1.16 | 0.29 | 0.99 | -0.65 | -0.20 |
| 6 | 0.37 | 0.31 | -0.49 | -0.48 | 0.12 | -0.11 | -0.27 | 1.28 | -0.08 | 0.14 |
| 7 | -0.39 | 0.54 | -0.18 | -0.22 | 0.00 | -0.06 | -0.30 | 1.06 | 0.15 | 0.59 |
| 8 | -1.52 | 0.50 | 0.17 | 0.43 | 0.44 | 0.29 | -0.39 | 1.35 | -0.68 | 1.14 |
| 9 | -0.21 | -1.08 | -0.11 | -0.41 | 0.90 | -0.58 | -0.59 | 0.70 | 0.00 | 1.03 |
| 10 | 0.38 | -0.94 | -3.19 | -0.32 | -0.03 | 0.63 | -1.86 | 0.93 | 0.00 | 0.07 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ave 2-10 | -0.15 | 0.01 | -0.42 | -0.11 | 0.14 | -0.15 | -0.29 | 0.55 | -0.17 | 0.14 |

| Age | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | -0.45 | 0.73 | 0.64 | -0.95 | 0.57 | 0.62 | 0.90 | -0.19 | -0.24 | 0.17 |
| 3 | 0.15 | -0.39 | 0.11 | 0.09 | 0.11 | 0.63 | 0.48 | -0.22 | -0.48 | -0.23 |
| 4 | 0.00 | 0.00 | -0.41 | -0.22 | 0.66 | 0.16 | 0.49 | 0.15 | -0.19 | -0.30 |
| 5 | 0.60 | -0.27 | 0.46 | -0.32 | 0.22 | 0.90 | -0.08 | -0.34 | 0.49 | 0.01 |
| 6 | 0.45 | 0.29 | 0.28 | -0.07 | 0.22 | 0.36 | 0.57 | -0.29 | -0.01 | -0.47 |
| 7 | 0.38 | 0.05 | 1.17 | -0.34 | 0.23 | 0.37 | 0.18 | -0.26 | -0.48 | -0.19 |
| 8 | 0.58 | -1.11 | 0.28 | 0.03 | 0.05 | 0.80 | 0.44 | -0.32 | -0.18 | -0.80 |
| 9 | 1.03 | 0.10 | 0.45 | 0.34 | 1.08 | 0.59 | 0.54 | -0.77 | -0.13 | -0.37 |
| 10 | 1.85 | 0.66 | 0.60 | 0.75 | -0.13 | 1.18 | 0.39 | 0.13 | 0.12 | -1.13 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ave 2-10 | 0.26 | 0.00 | 0.20 | -0.04 | 0.17 | 0.31 | 0.22 | -0.12 | -0.06 | -0.18 |

| Age | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 0.34 | -0.65 | -0.36 | -1.39 | -0.12 | 0.92 | 0.51 | 0.24 | 0.24 | 0.79 |
| 3 | 0.24 | 0.60 | -0.94 | -0.62 | -0.59 | 0.63 | 0.99 | 0.31 | 0.06 | 0.51 |
| 4 | -0.15 | 0.68 | 0.39 | -1.14 | -0.29 | 0.22 | 0.88 | 0.49 | -0.01 | 0.50 |
| 5 | 0.44 | 0.41 | 0.29 | -0.65 | -1.47 | -0.12 | 0.62 | -0.11 | 0.15 | -0.14 |
| 6 | 0.27 | 0.76 | -0.14 | -0.82 | -0.21 | -0.57 | 0.09 | -0.24 | -0.52 | 0.21 |
| 7 | 0.53 | 0.39 | 0.08 | -1.60 | -0.54 | -0.05 | 0.19 | -0.64 | 0.02 | 0.28 |
| 8 | 0.27 | 0.89 | 0.19 | -0.05 | -1.36 | -1.00 | 0.65 | -1.07 | 0.53 | 0.34 |
| 9 | -0.50 | 0.47 | 0.49 | -1.12 | -0.52 | -1.42 | -0.46 | -0.59 | -0.18 | 0.81 |
| 10 | 0.13 | 0.67 | 0.11 | -0.53 | -0.21 | 0.00 | 0.37 | -0.67 | -0.61 | -0.06 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0.01 | -0.21 | 0.64 | 0.53 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0.34 | 0.11 | -0.02 | 0.50 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0.04 | 0.41 | -0.06 | 0.11 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0.05 | -0.06 | 0.04 | -0.31 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | -0.19 | 0.08 | -0.62 | 0.29 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0.01 | -0.30 | -0.28 | 0.27 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0.30 | -0.63 | -0.02 | 0.06 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 | -0.89 | -0.34 | -0.22 | 0.54 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0.03 | -0.51 | -0.32 | -0.53 |
| Ave 2-10 | 0.09 | 0.23 | 0.01 | -0.44 | -0.30 | -0.08 | 0.20 | -0.21 | -0.07 | 0.26 |

| Age | 2000 | 2001 | 2002 |
|---|---|---|---|
| 2 | 0.15 | 0.29 | -0.24 |
| 3 | -0.26 | 0.11 | 0.00 |
| 4 | -0.05 | 0.43 | -0.26 |
| 5 | 0.12 | 0.06 | -0.15 |
| 6 | -0.69 | -0.20 | -0.08 |
| 7 | -0.69 | -0.43 | 0.15 |
| 8 | -0.50 | 0.06 | -0.42 |
| 9 | -0.45 | 0.52 | 0.44 |
| 10 | -1.29 | 1.02 | 0.98 |
| 2 | -0.25 | -0.10 | -0.62 |
| 3 | -0.34 | -0.22 | -0.37 |
| 4 | 0.04 | 0.05 | -0.59 |
| 5 | 0.57 | -0.03 | -0.26 |
| 6 | 0.09 | 0.12 | 0.23 |
| 7 | -0.02 | -0.14 | 0.45 |
| 8 | 0.17 | 0.31 | -0.20 |
| 9 | -0.27 | 0.63 | 0.55 |
| 10 | -0.72 | 1.04 | 1.03 |
| Ave 2-10 | -0.24 | 0.20 | 0.03 |

Mean Square of the Residuals = 0.364781

| | Est. Param | CV | Bias |
|---|---|---|---|
| 1 | 10.3498 | 0.451424 | -0.02013 |
| 2 | 10.6555 | 0.321857 | -0.01947 |
| 3 | 10.7682 | 0.269986 | -0.01192 |
| 4 | 9.36049 | 0.242782 | -0.00458 |
| 5 | 8.68895 | 0.234021 | 0.0126 |
| 6 | 8.04806 | 0.232502 | 0.032957 |
| 7 | 8.82439 | 0.220007 | 0.030783 |
| 8 | 7.79099 | 0.253963 | 0.073917 |
| 9 | 6.48612 | 0.278497 | 0.130079 |

Table 1°3. SPA results - Population Numbers (000s)

| Age | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 25931 | 6199 | 48001 | 45063 | 24733 | 50508 | 53828 | 32683 | 44025 | 33900 |
| 2 | 12185 | 21230 | 5075 | 39262 | 36757 | 20249 | 41319 | 44054 | 26757 | 36045 |
| 3 | 5728 | 8992 | 16650 | 4136 | 29328 | 29449 | 14590 | 32647 | 34902 | 21837 |
| 4 | 7861 | 4014 | 5860 | 10474 | 3283 | 19684 | 19933 | 10446 | 23891 | 25451 |
| 5 | 2619 | 5034 | 2554 | 3105 | 6518 | 2400 | 11392 | 12434 | 6719 | 13026 |
| 6 | 2723 | 1790 | 2801 | 1623 | 1565 | 3681 | 1522 | 5968 | 7281 | 3550 |
| 7 | 15119 | 1740 | 1090 | 1699 | 847 | 808 | 2005 | 850 | 2271 | 3322 |
| 8 | 7374 | 8144 | 1360 | 810 | 842 | 518 | 435 | 906 | 370 | 890 |
| 9 | 750 | 4299 | 3588 | 1061 | 368 | 439 | 266 | 216 | 389 | 175 |
| 10 | 442 | 490 | 2572 | 1865 | 632 | 129 | 302 | 153 | 80 | 219 |
| 1-10 | 80731 | 61932 | 89552 | 109099 | 104872 | 127864 | 145592 | 140357 | 146684 | 138415 |

| Age | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 42491 | 45139 | 35683 | 41749 | 16036 | 12076 | 5759 | 8562 | 25507 | 23699 |
| 2 | 27755 | 34774 | 36956 | 29215 | 34181 | 13127 | 9887 | 4715 | 7010 | 20872 |
| 3 | 29436 | 22575 | 27376 | 29781 | 23855 | 27295 | 10541 | 7829 | 3779 | 5546 |
| 4 | 16807 | 21841 | 16431 | 18889 | 21106 | 18450 | 20442 | 7587 | 5466 | 2631 |
| 5 | 14629 | 10982 | 12119 | 11056 | 10018 | 12714 | 12884 | 12329 | 3470 | 3556 |
| 6 | 7073 | 6976 | 5100 | 5440 | 5339 | 4847 | 6195 | 6910 | 5943 | 2031 |
| 7 | 1917 | 2558 | 2751 | 2526 | 2233 | 2034 | 2604 | 3704 | 3761 | 3085 |
| 8 | 1569 | 1083 | 1016 | 841 | 1134 | 904 | 1205 | 1927 | 2769 | 2291 |
| 9 | 485 | 709 | 555 | 503 | 295 | 596 | 617 | 898 | 1525 | 1458 |
| 10 | 91 | 241 | 281 | 277 | 225 | 134 | 442 | 472 | 729 | 912 |
| 1-10 | 142252 | 146877 | 138268 | 140276 | 114423 | 92177 | 70576 | 54934 | 59960 | 66080 |

| Age | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8332 | 11312 | 13553 | 21140 | 34043 | 46179 | 16827 | 22845 | 31504 | 100607 |
| 2 | 19391 | 6821 | 9259 | 11089 | 17288 | 27863 | 37806 | 13777 | 18704 | 25793 |
| 3 | 16916 | 15511 | 5538 | 7453 | 8953 | 14066 | 22722 | 30919 | 11268 | 15285 |
| 4 | 4091 | 12563 | 11520 | 4314 | 5461 | 6997 | 10831 | 17872 | 24838 | 9091 |
| 5 | 1702 | 2993 | 8159 | 7149 | 3062 | 3899 | 5101 | 7969 | 13115 | 19384 |
| 6 | 2064 | 1070 | 1926 | 4608 | 4199 | 2211 | 2634 | 3559 | 5612 | 9114 |
| 7 | 1382 | 1263 | 653 | 1369 | 2804 | 2559 | 1595 | 1769 | 2502 | 3566 |
| 8 | 1874 | 778 | 754 | 311 | 967 | 2053 | 1689 | 984 | 1205 | 1564 |
| 9 | 1460 | 943 | 456 | 318 | 159 | 770 | 1300 | 986 | 681 | 689 |
| 10 | 738 | 944 | 491 | 159 | 194 | 115 | 484 | 743 | 707 | 394 |
| 1-10 | 57950 | 54199 | 52308 | 57909 | 77129 | 106711 | 100988 | 101423 | 110138 | 185486 |

| Age | 2000 | 2001 | 2002 |
|---|---|---|---|
| 1 | 71138 | 42207 | 15816 |
| 2 | 82370 | 58243 | 34556 |
| 3 | 21086 | 67221 | 47629 |
| 4 | 12123 | 16881 | 53796 |
| 5 | 6988 | 9232 | 13048 |
| 6 | 14814 | 5198 | 6913 |
| 7 | 6664 | 11075 | 3788 |
| 8 | 2405 | 4655 | 8042 |
| 9 | 1059 | 1492 | 3010 |
| 10 | 514 | 677 | 863 |
| 1-10 | 219160 | 216881 | 187463 |

Table 18b. SPA results - Fishing Mortaity

| Age | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 0.10 | 0.04 | 0.00 | 0.09 | 0.02 | 0.13 | 0.04 | 0.03 | 0.00 | 0.00 |
| 3 | 0.16 | 0.23 | 0.26 | 0.03 | 0.20 | 0.19 | 0.13 | 0.11 | 0.12 | 0.06 |
| 4 | 0.25 | 0.25 | 0.44 | 0.27 | 0.11 | 0.35 | 0.27 | 0.24 | 0.41 | 0.35 |
| 5 | 0.18 | 0.39 | 0.25 | 0.49 | 0.37 | 0.26 | 0.45 | 0.34 | 0.44 | 0.41 |
| 6 | 0.25 | 0.30 | 0.30 | 0.45 | 0.46 | 0.41 | 0.38 | 0.77 | 0.58 | 0.42 |
| 7 | 0.42 | 0.05 | 0.10 | 0.50 | 0.29 | 0.42 | 0.59 | 0.63 | 0.74 | 0.55 |
| 8 | 0.34 | 0.62 | 0.05 | 0.59 | 0.45 | 0.46 | 0.50 | 0.65 | 0.55 | 0.41 |
| 9 | 0.23 | 0.31 | 0.45 | 0.32 | 0.85 | 0.17 | 0.35 | 0.79 | 0.37 | 0.46 |
| 10 | 0.28 | 0.47 | 0.25 | 0.45 | 0.65 | 0.32 | 0.43 | 0.72 | 0.46 | 0.43 |
| 5-7 | 0.28 | 0.24 | 0.22 | 0.48 | 0.37 | 0.36 | 0.47 | 0.58 | 0.59 | 0.46 |

| Age | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 0.01 | 0.04 | 0.02 | 0.00 | 0.02 | 0.02 | 0.03 | 0.02 | 0.03 | 0.01 |
| 3 | 0.10 | 0.12 | 0.17 | 0.14 | 0.06 | 0.09 | 0.13 | 0.16 | 0.16 | 0.10 |
| 4 | 0.23 | 0.39 | 0.20 | 0.43 | 0.31 | 0.16 | 0.31 | 0.58 | 0.23 | 0.24 |
| 5 | 0.54 | 0.57 | 0.60 | 0.53 | 0.53 | 0.52 | 0.42 | 0.53 | 0.34 | 0.34 |
| 6 | 0.82 | 0.73 | 0.50 | 0.69 | 0.77 | 0.42 | 0.31 | 0.41 | 0.46 | 0.18 |
| 7 | 0.37 | 0.72 | 0.99 | 0.60 | 0.70 | 0.32 | 0.10 | 0.09 | 0.30 | 0.30 |
| 8 | 0.59 | 0.47 | 0.50 | 0.85 | 0.44 | 0.18 | 0.09 | 0.03 | 0.44 | 0.25 |
| 9 | 0.50 | 0.73 | 0.49 | 0.60 | 0.59 | 0.10 | 0.07 | 0.01 | 0.31 | 0.48 |
| 10 | 0.55 | 0.60 | 0.50 | 0.72 | 0.52 | 0.14 | 0.08 | 0.02 | 0.38 | 0.37 |
| 5-7 | 0.58 | 0.67 | 0.70 | 0.61 | 0.67 | 0.42 | 0.28 | 0.34 | 0.36 | 0.28 |

| Age | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 3 | 0.10 | 0.10 | 0.05 | 0.11 | 0.05 | 0.06 | 0.04 | 0.02 | 0.01 | 0.03 |
| 4 | 0.11 | 0.23 | 0.28 | 0.14 | 0.14 | 0.12 | 0.11 | 0.11 | 0.05 | 0.06 |
| 5 | 0.26 | 0.24 | 0.37 | 0.33 | 0.13 | 0.19 | 0.16 | 0.15 | 0.16 | 0.07 |
| 6 | 0.29 | 0.29 | 0.14 | 0.30 | 0.30 | 0.13 | 0.20 | 0.15 | 0.25 | 0.11 |
| 7 | 0.37 | 0.32 | 0.54 | 0.15 | 0.11 | 0.22 | 0.28 | 0.18 | 0.27 | 0.19 |
| 8 | 0.49 | 0.33 | 0.66 | 0.47 | 0.03 | 0.26 | 0.34 | 0.17 | 0.36 | 0.19 |
| 9 | 0.24 | 0.45 | 0.86 | 0.29 | 0.13 | 0.26 | 0.36 | 0.13 | 0.35 | 0.09 |
| 10 | 0.36 | 0.39 | 0.76 | 0.38 | 0.08 | 0.26 | 0.35 | 0.15 | 0.35 | 0.14 |
| 5-7 | 0.31 | 0.28 | 0.35 | 0.26 | 0.18 | 0.18 | 0.21 | 0.16 | 0.23 | 0.13 |

| Age | 2000 | 2001 | 2002* |
|---|---|---|---|
| 1 | 0.00 | 0.00 | 0.00 |
| 2 | 0.00 | 0.00 | 0.00 |
| 3 | 0.02 | 0.02 | 0.00 |
| 4 | 0.07 | 0.06 | 0.02 |
| 5 | 0.10 | 0.09 | 0.03 |
| 6 | 0.09 | 0.12 | 0.05 |
| 7 | 0.16 | 0.12 | 0.09 |
| 8 | 0.28 | 0.24 | 0.07 |
| 9 | 0.25 | 0.35 | 0.11 |
| 10 | 0.26 | 0.29 | 0.15 |
| 5-7 | 0.12 | 0.11 | 0.06 |

* 2002 landings to June 30 only

Table 18c. SPA results - Biomass (t)

| Age | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1178 | 282 | 3471 | 1804 | 1242 | 2134 | 2895 | 1297 | 2265 | 1001 |
| 2 | 3426 | 2990 | 730 | 5966 | 6197 | 3628 | 7994 | 8993 | 5519 | 5480 |
| 3 | 3654 | 4914 | 6741 | 1331 | 13426 | 14262 | 7388 | 18105 | 22530 | 12402 |
| 4 | 7373 | 3644 | 5839 | 9883 | 2358 | 18635 | 18704 | 9767 | 26471 | 28251 |
| 5 | 3352 | 6238 | 3397 | 4776 | 9909 | 3239 | 15819 | 17821 | 10526 | 20899 |
| 6 | 4228 | 2679 | 4716 | 3196 | 3140 | 7267 | 2833 | 10440 | 14566 | 7655 |
| 7 | 29675 | 2893 | 2031 | 3712 | 2070 | 2023 | 4692 | 1999 | 5229 | 8221 |
| 8 | 16371 | 17149 | 2822 | 1863 | 2134 | 1426 | 1130 | 2403 | 1158 | 2654 |
| 9 | 1368 | 10575 | 9019 | 2766 | 965 | 1295 | 758 | 669 | 1885 | 650 |
| 10 | 1221 | 1528 | 8243 | 5393 | 1747 | 382 | 879 | 432 | 288 | 1158 |
| 1-10 | 71846 | 52892 | 47008 | 40689 | 43188 | 54291 | 63091 | 71926 | 90437 | 88371 |
| 4+ | 63588 | 44706 | 36067 | 31589 | 22323 | 34267 | 44815 | 43531 | 60123 | 69488 |

| Age | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1504 | 1406 | 1552 | 867 | 238 | 502 | 213 | 179 | 1003 | 1108 |
| 2 | 5272 | 5950 | 4779 | 3109 | 3681 | 2176 | 1426 | 635 | 1542 | 3777 |
| 3 | 15397 | 13919 | 14274 | 10430 | 7986 | 10891 | 4709 | 3186 | 1834 | 3457 |
| 4 | 16994 | 21315 | 17480 | 16335 | 14312 | 10735 | 13343 | 5797 | 4139 | 2084 |
| 5 | 22655 | 17154 | 17301 | 15937 | 11871 | 11683 | 11086 | 11667 | 3964 | 4015 |
| 6 | 13621 | 14040 | 10618 | 9731 | 9138 | 6424 | 6757 | 7437 | 7511 | 2897 |
| 7 | 4675 | 6175 | 7084 | 5946 | 4415 | 3931 | 3659 | 4817 | 5162 | 4508 |
| 8 | 4253 | 3016 | 3087 | 2324 | 2737 | 1829 | 2229 | 2970 | 4256 | 3741 |
| 9 | 1654 | 2125 | 1817 | 1543 | 811 | 1297 | 1278 | 1688 | 2772 | 2332 |
| 10 | 332 | 891 | 1050 | 917 | 734 | 356 | 912 | 938 | 1453 | 1726 |
| 1-10 | 86358 | 85989 | 79043 | 67139 | 55924 | 49824 | 45613 | 39315 | 33636 | 29646 |
| 4+ | 64184 | 64716 | 58437 | 52733 | 44018 | 36255 | 39264 | 35314 | 29257 | 21303 |

| Age | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 340 | 526 | 585 | 821 | 1606 | 4028 | 581 | 580 | 2374 | 3845 |
| 2 | 3767 | 1744 | 1478 | 1921 | 3520 | 6172 | 4348 | 1524 | 3226 | 2851 |
| 3 | 9134 | 9252 | 3389 | 3624 | 5038 | 8329 | 11133 | 9270 | 3463 | 5738 |
| 4 | 4090 | 13117 | 11271 | 3589 | 5323 | 7000 | 10848 | 13124 | 12805 | 4526 |
| 5 | 2112 | 4244 | 12149 | 9016 | 3734 | 5190 | 6607 | 9551 | 12076 | 13832 |
| 6 | 3216 | 2007 | 3347 | 7928 | 6381 | 3173 | 4211 | 5057 | 7358 | 9261 |
| 7 | 2480 | 2487 | 1430 | 2705 | 5188 | 4411 | 2708 | 3030 | 3950 | 4644 |
| 8 | 3443 | 1654 | 1437 | 644 | 2052 | 4222 | 3116 | 1860 | 2261 | 2398 |
| 9 | 2948 | 1974 | 940 | 498 | 271 | 1909 | 3047 | 1869 | 1336 | 1180 |
| 10 | 1180 | 1947 | 1108 | 335 | 299 | 207 | 1234 | 1456 | 1224 | 770 |
| 1-10 | 32710 | 38953 | 37133 | 31079 | 33412 | 44641 | 47832 | 47320 | 50074 | 49047 |
| 4+ | 19469 | 27430 | 31682 | 24715 | 23248 | 26112 | 31771 | 35947 | 41010 | 36611 |

| Age | 2000 | 2001 | 2002 |
|---|---|---|---|
| 1 | 3806 | 3090 | 0 |
| 2 | 16653 | 9279 | 4660 |
| 3 | 6896 | 31024 | 14530 |
| 4 | 8395 | 10203 | 31560 |
| 5 | 4871 | 8367 | 8816 |
| 6 | 13501 | 4496 | 6360 |
| 7 | 7559 | 11368 | 3622 |
| 8 | 3265 | 5912 | 8173 |
| 9 | 1714 | 2234 | 3548 |
| 10 | 945 | 1022 | 1113 |
| 1-10 | 67604 | 86995 | 82381 |
| 4+ | 40250 | 43602 | 63192 |

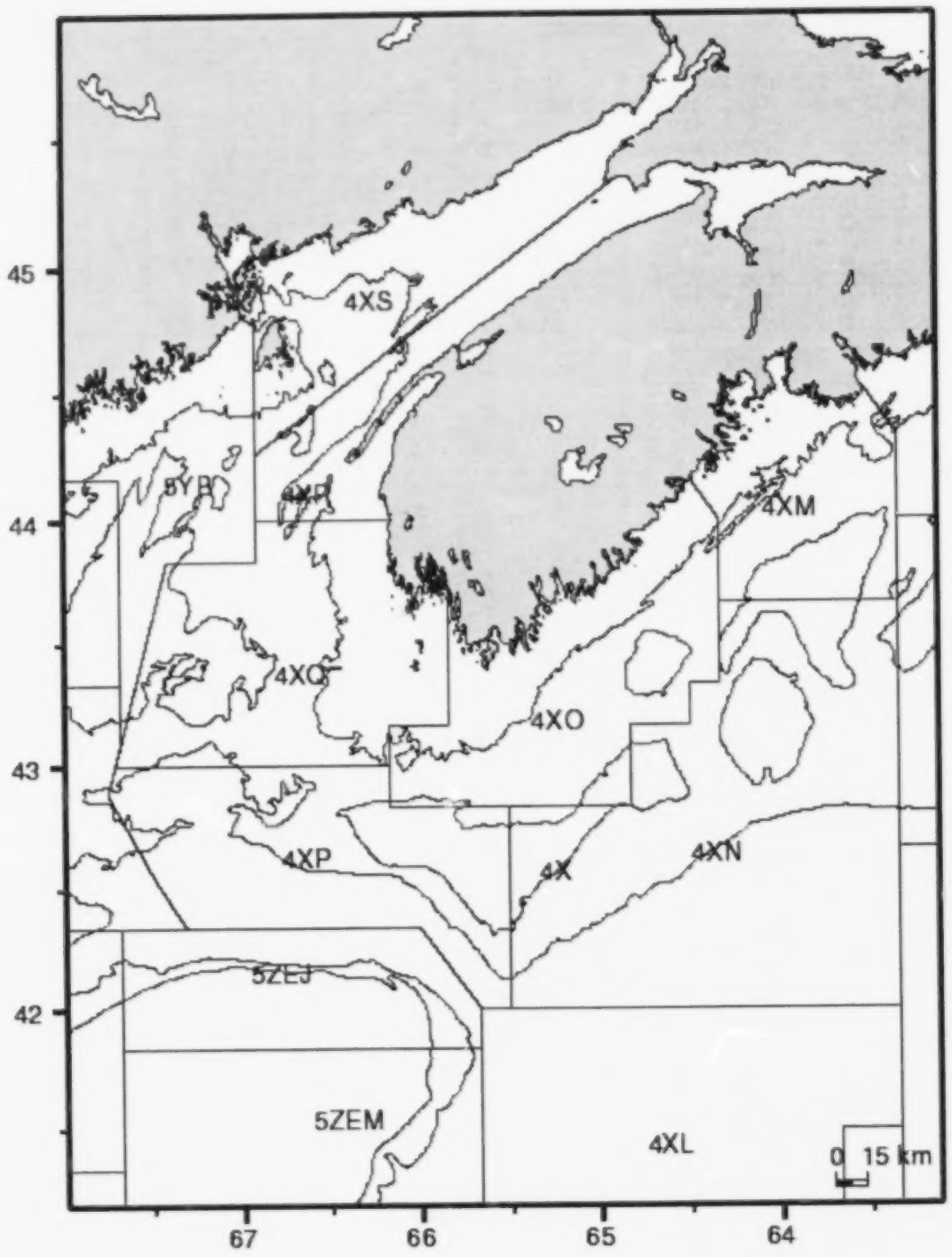



Figure 1. Statistical unit areas in Div. 4X, 5Y and 5Z.

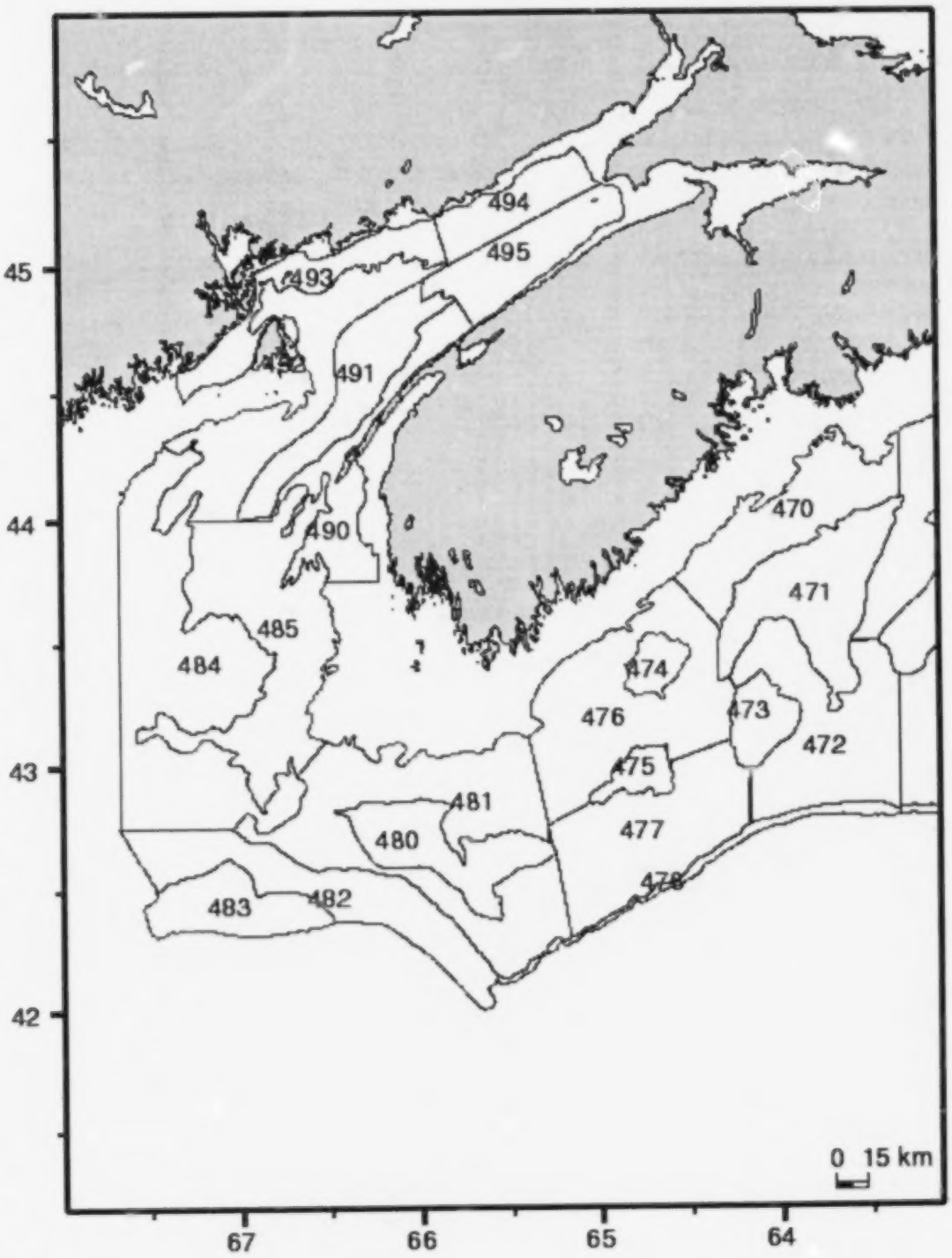



Figure 2. Stratification scheme for the summer RV survey in Div. 4X.

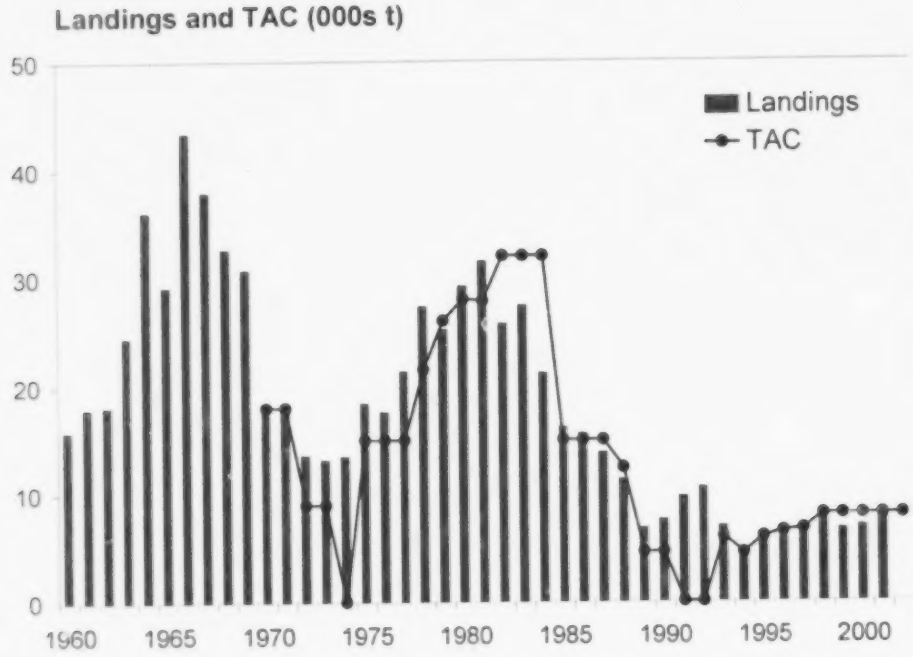



Figure 3. Long-term trends in 4X/5Y haddock landings and TACs.

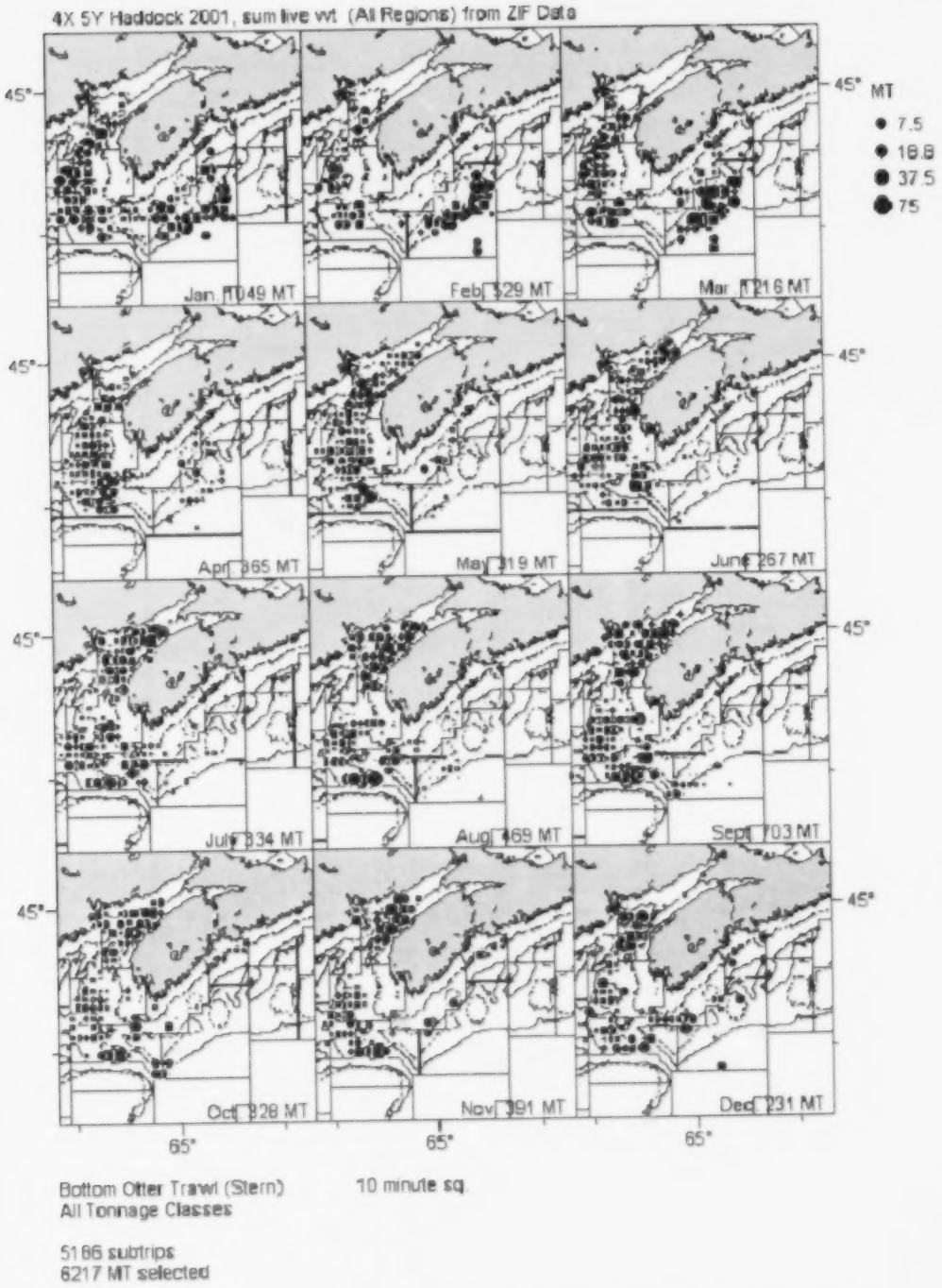



Figure 4a. Haddock catches by stern trawls in NAFO Div. 4X/5Y by month in 2001, aggregated by 10x10 minute squares (where catch position was reported).

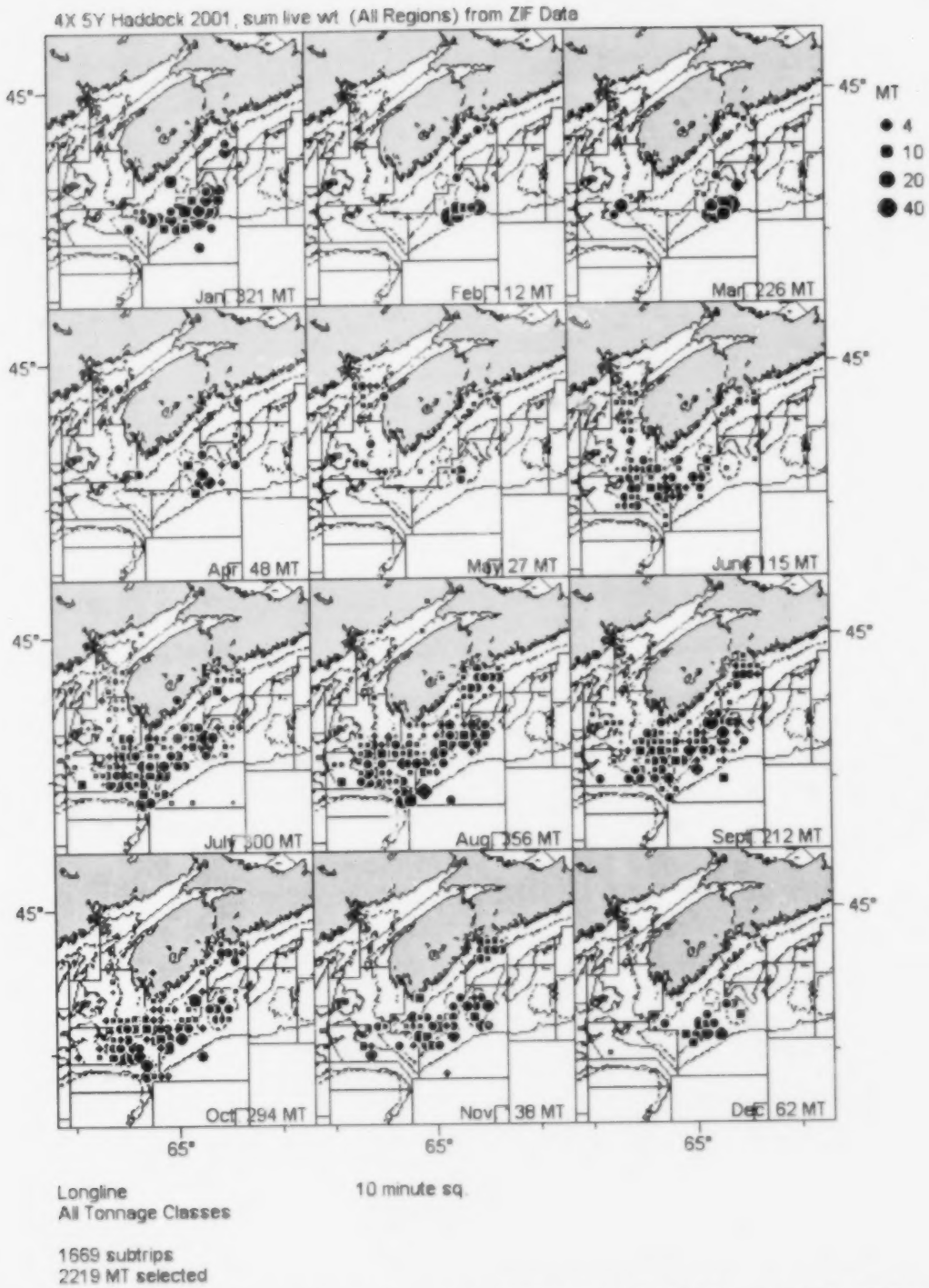



Figure 4b. Haddock catches by longlines in NAFO Div. 4X/5Y by month in 2001, aggregated by 10x10 minute squares (where catch position was reported).

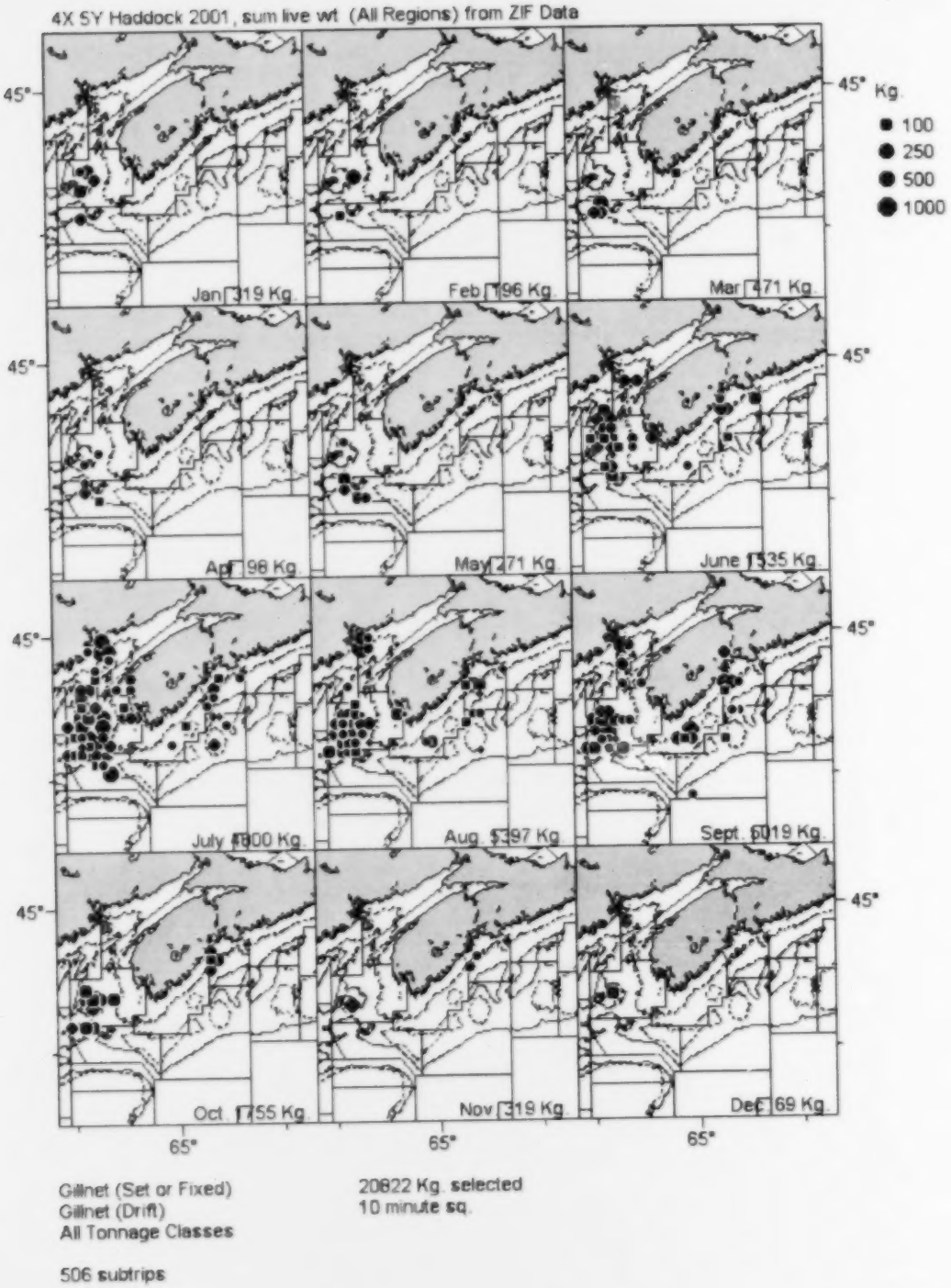



Figure 4c. Haddock catches by gillnets in NAFO Div. 4X/5Y by month in 2001, aggregated by 10x10 minute squares (where catch position was reported).

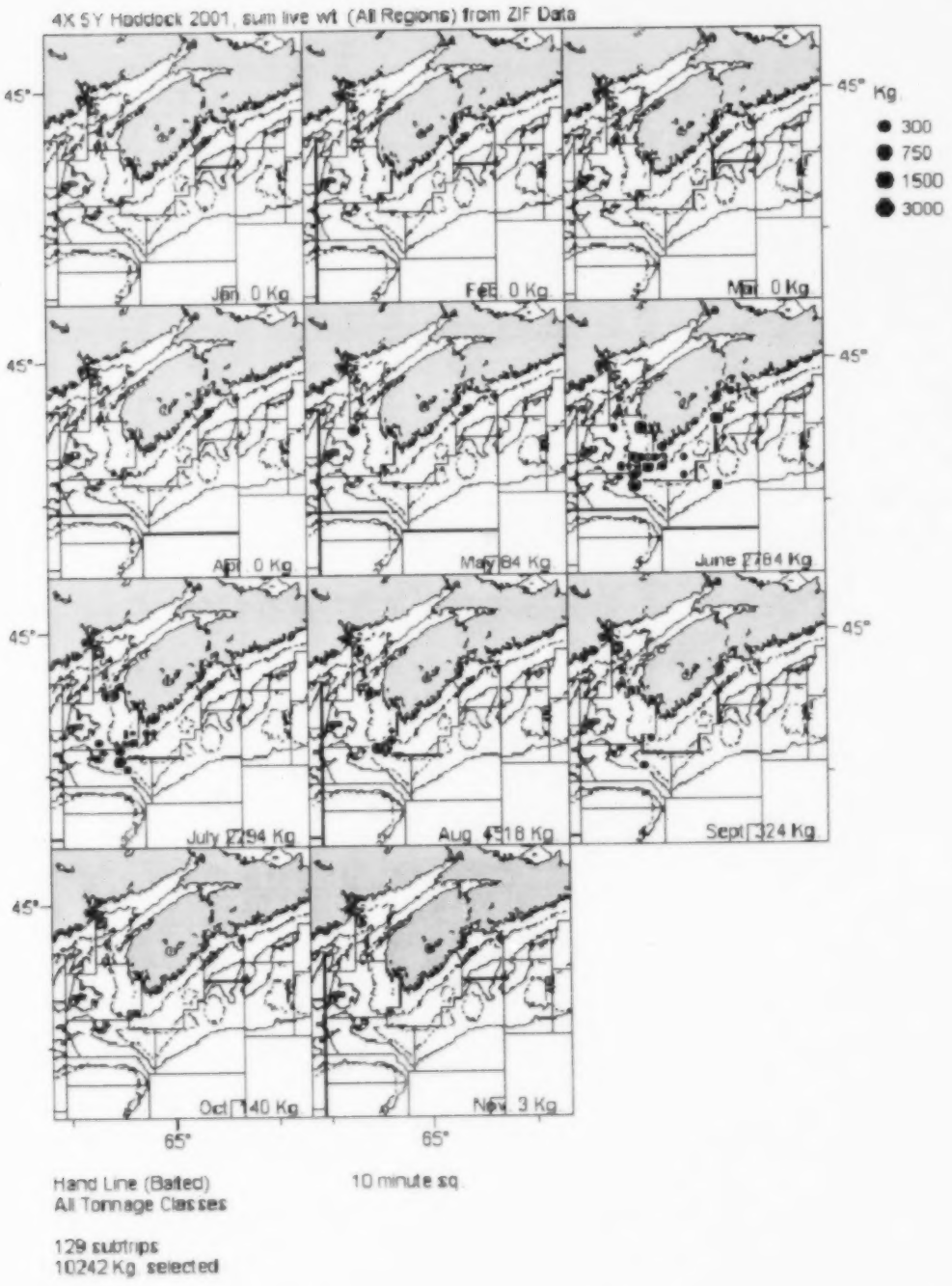



Figure 4d. Haddock catches by handlines in NAFO Div. 4X/5Y by month in 2001, aggregated by 10x10 minute squares (where catch position was reported).

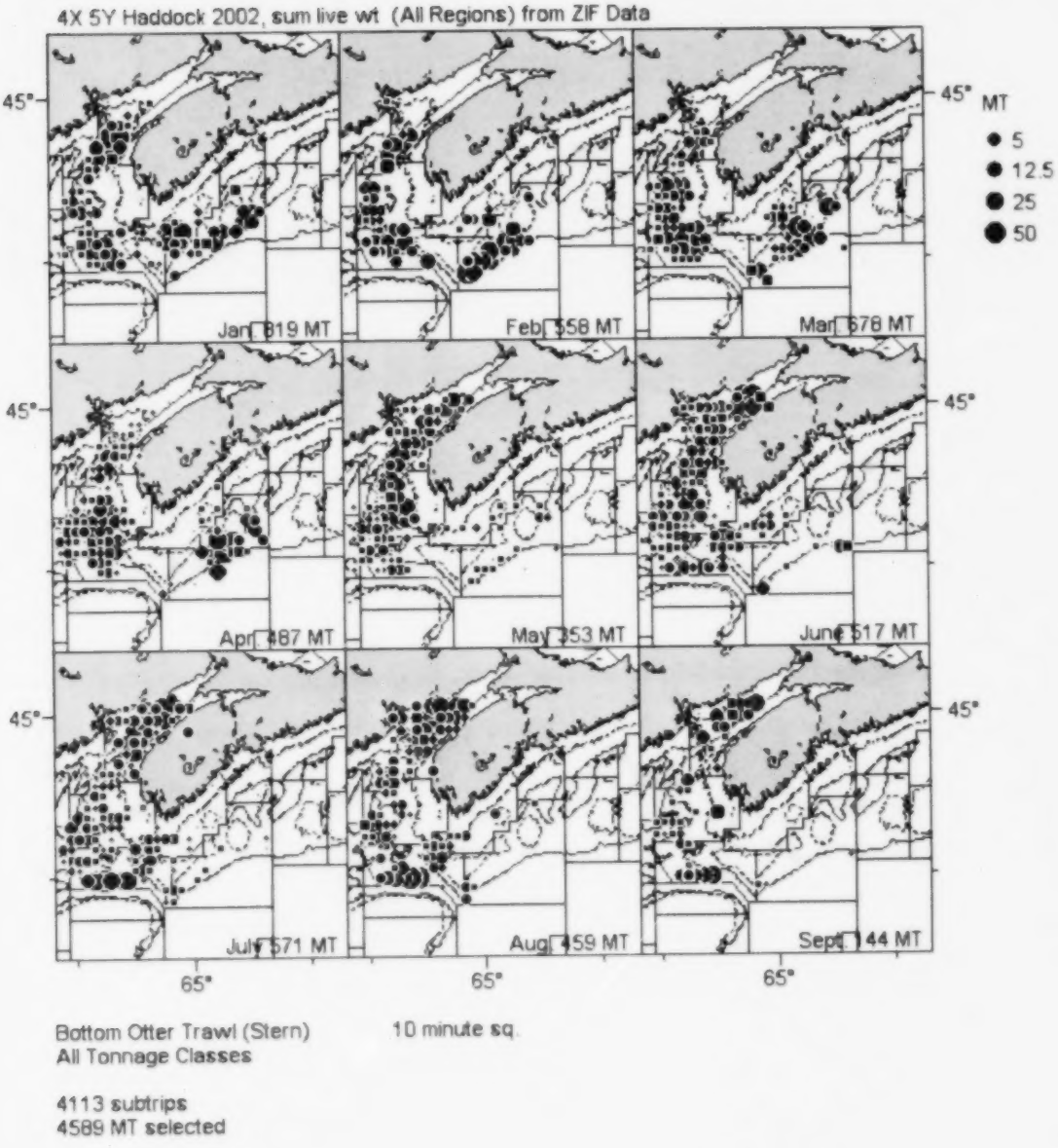



Figure 5a. Haddock catches by stern trawls in NAFO Div. 4X/5Y by month in 2002, aggregated by 10x10 minute squares (where catch position was reported).

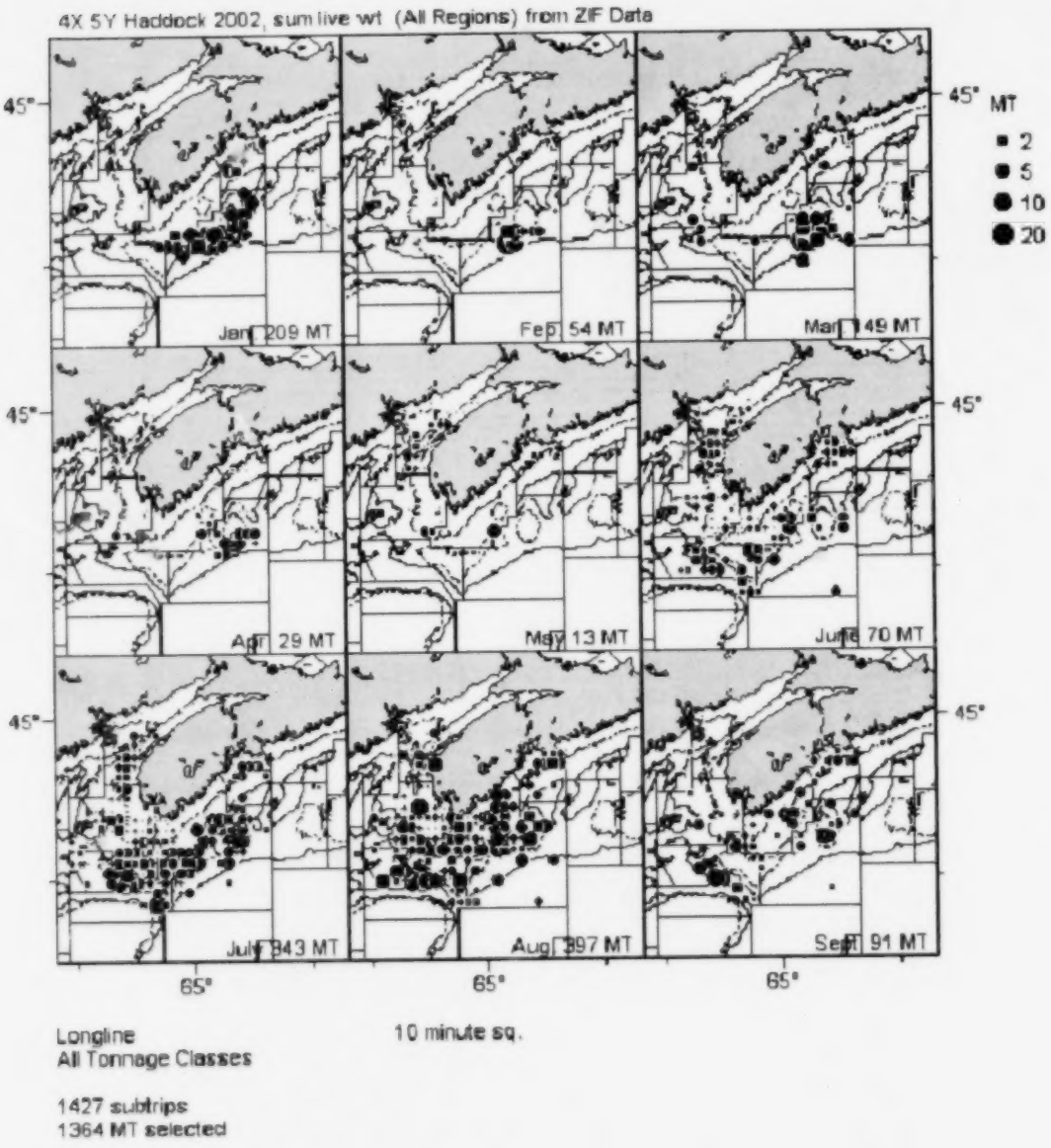



Figure 5b. Haddock catches by longlines in NAFO Div. 4X/5Y by month in 2002, aggregated by 10x10 minute squares (where catch position was reported).

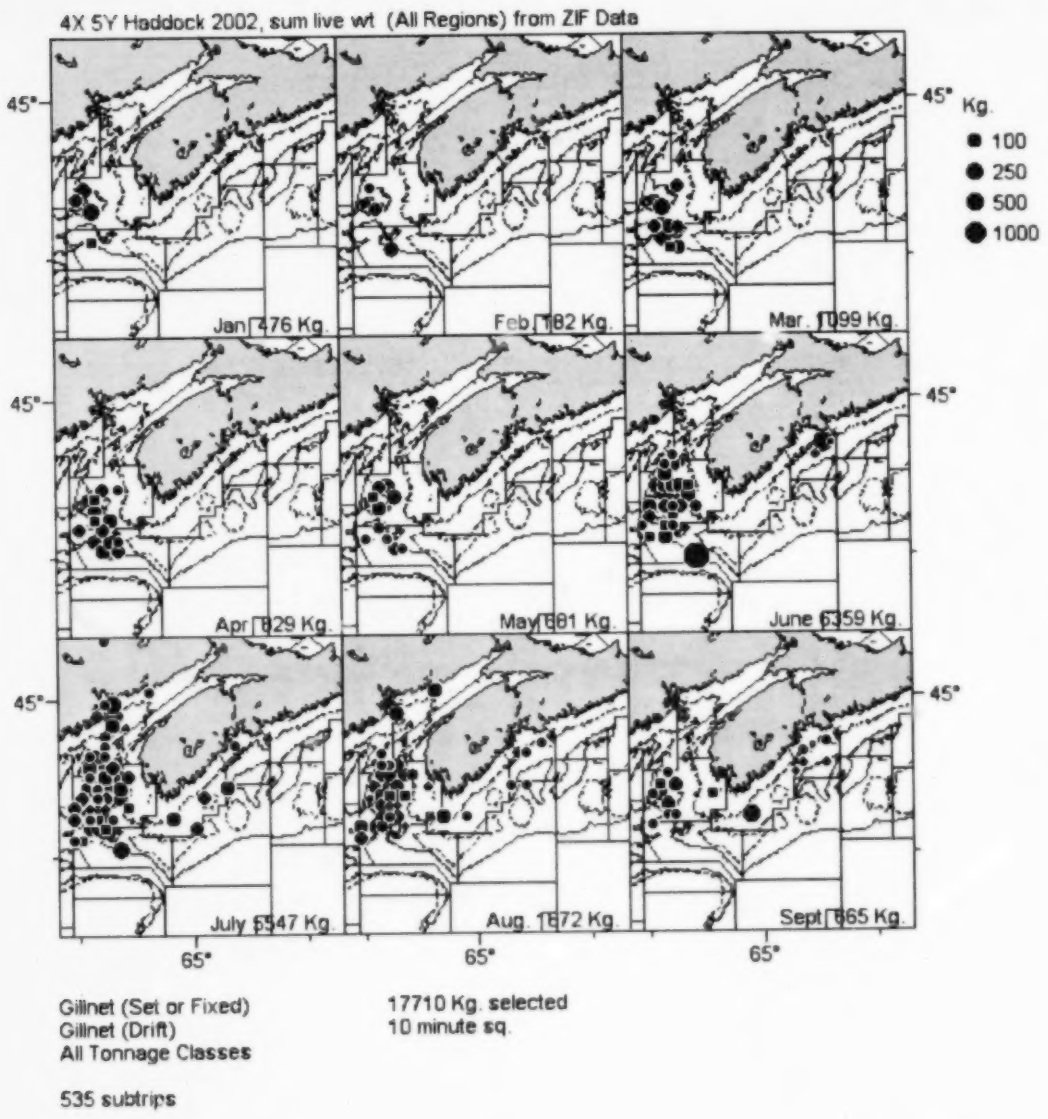



Figure 5c. Haddock catches by gillnets in NAFO Div. 4X/5Y by month in 2002, aggregated by 10x10 minute squares (where catch position was reported).

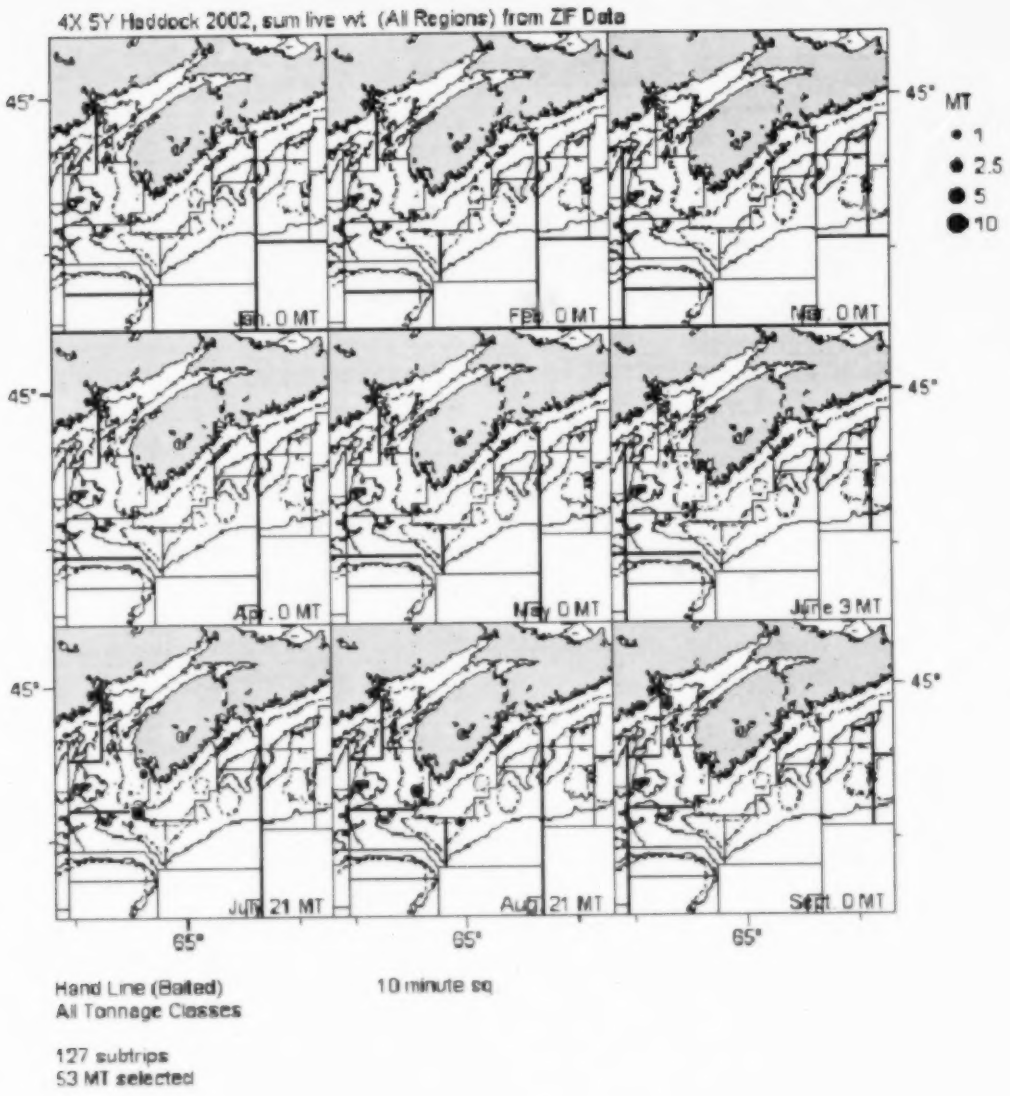
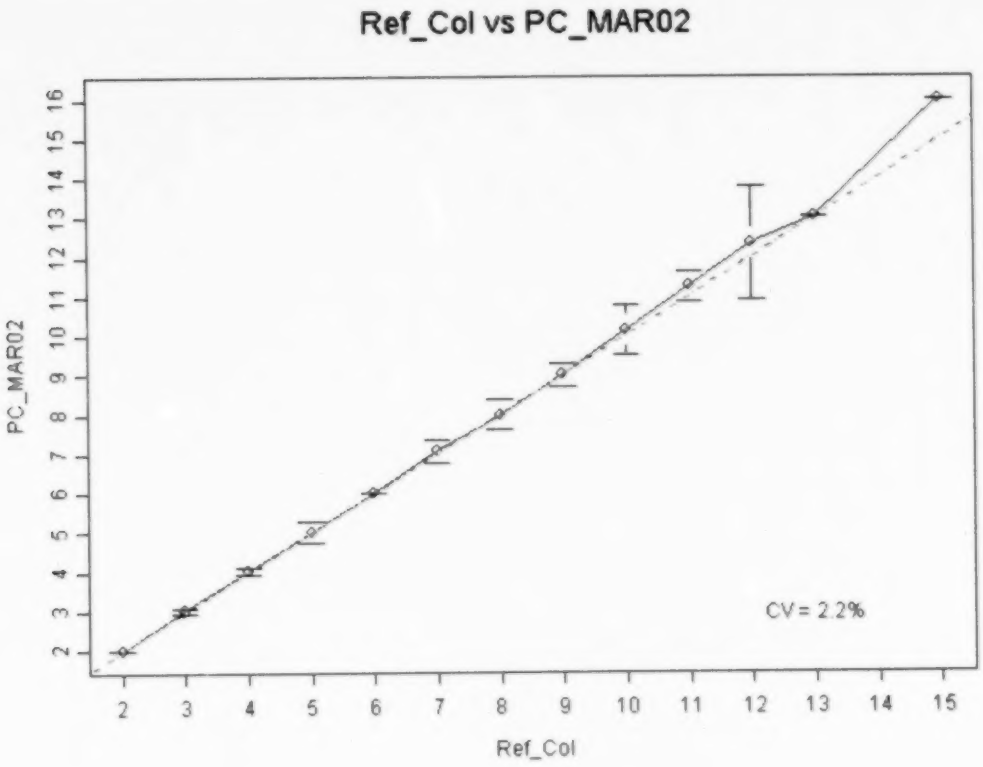



Figure 5d. Haddock catches by handlines in NAFO Div. 4X/5Y by month in 2002, aggregated by 10x10 minute squares (where catch position was reported).




PC_MAR02

| Ref_Col | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 16 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 3 | 2 | 48 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 53 |
| 4 | 0 | 4 | 67 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 77 |
| 5 | 0 | 0 | 1 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 6 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 7 | 0 | 0 | 0 | 0 | 1 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| 8 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 2 | 0 | 0 | 0 | 0 | 0 | 12 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 1 | 0 | 0 | 0 | 0 | 11 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 2 | 0 | 0 | 0 | 7 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 2 | 0 | 0 | 8 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 3 |
| 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Total | 5 | 52 | 71 | 16 | 4 | 12 | 11 | 12 | 5 | 8 | 4 | 2 | 1 | 203 |

Figure 6. Comparison of ages read by the primary ager against the haddock reference collection in March 2002.

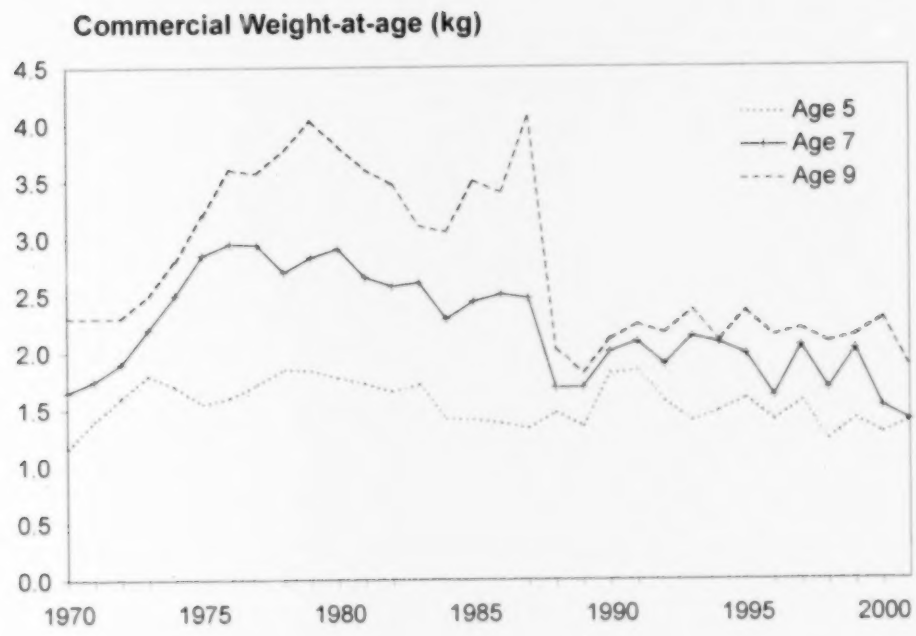



Figure 7. 4X haddock commercial mean weight-at-age (kg).

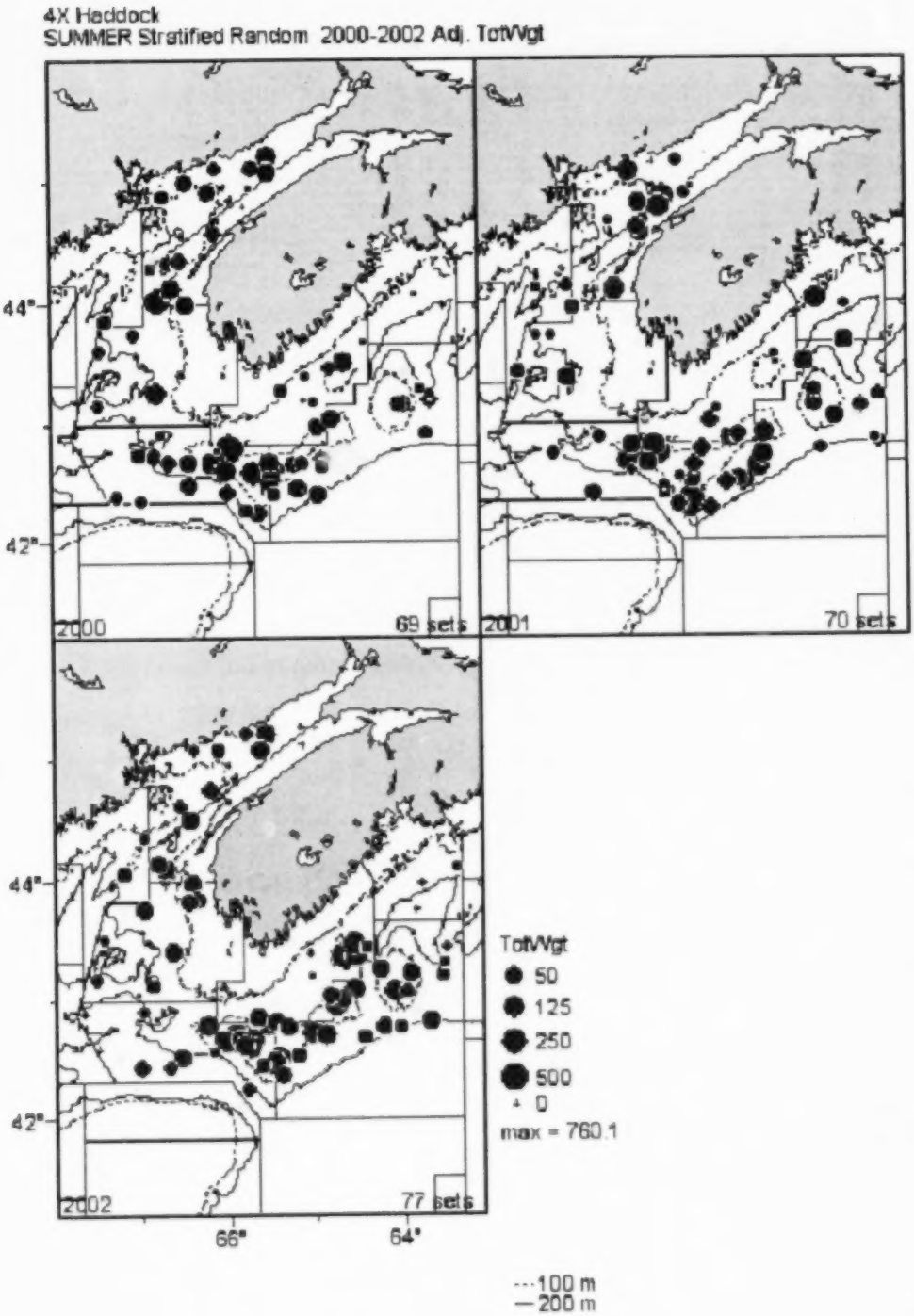



Figure 8. 4X haddock catches (kg) per standard tow from the 2000-2002 summer RV survey.

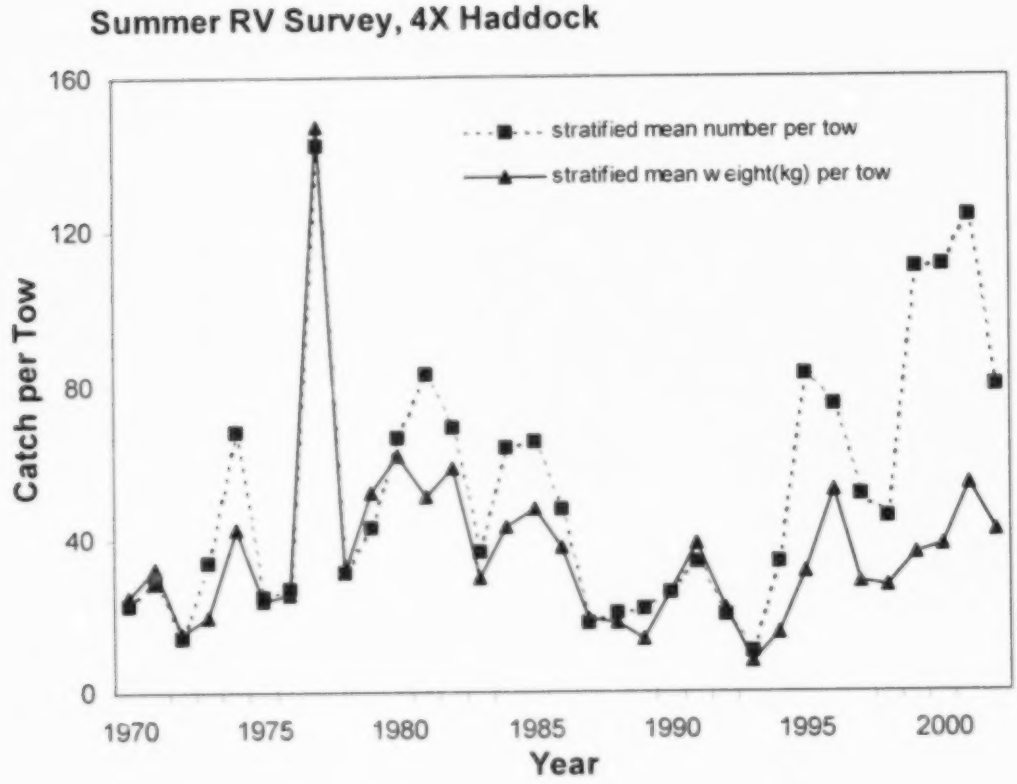



Figure 9. 4X haddock mean number and mean weight per tow from the summer RV survey, 1970-2002.

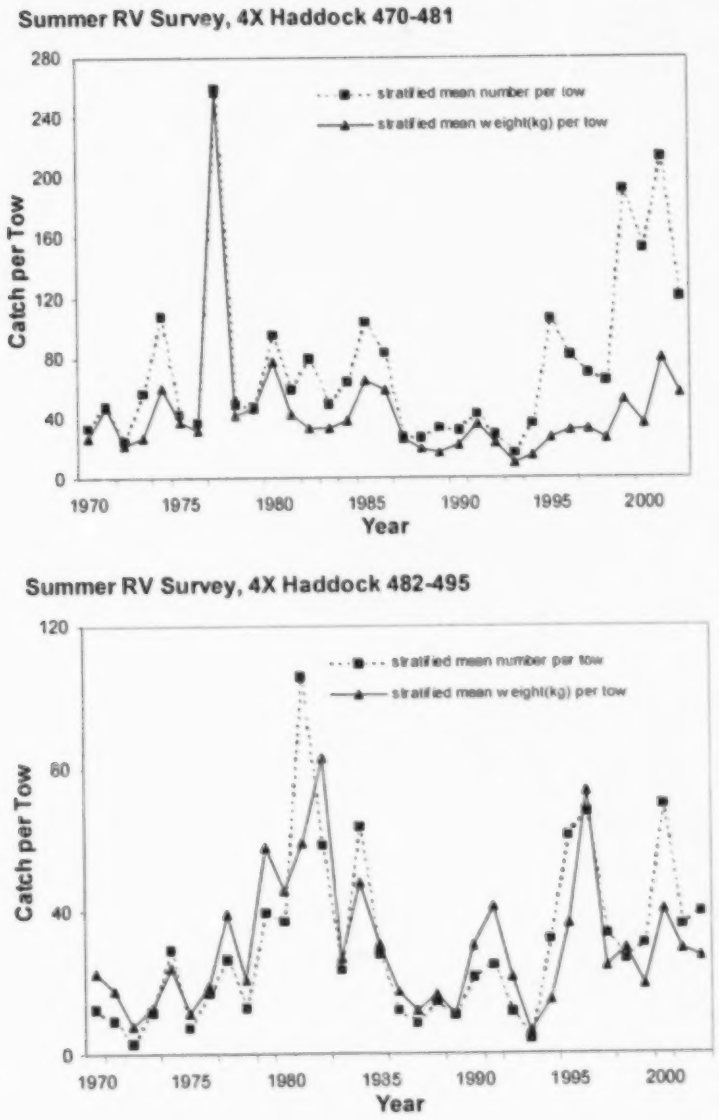
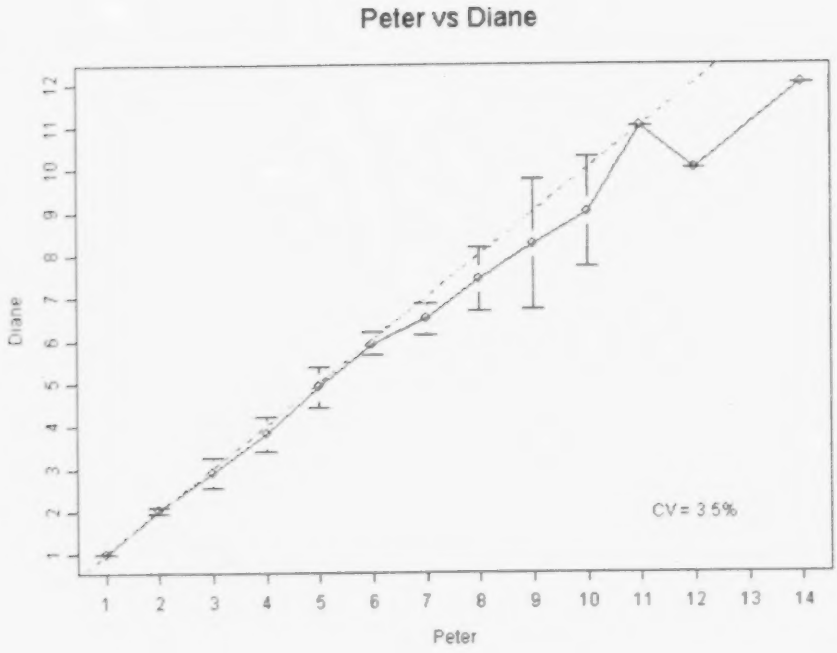
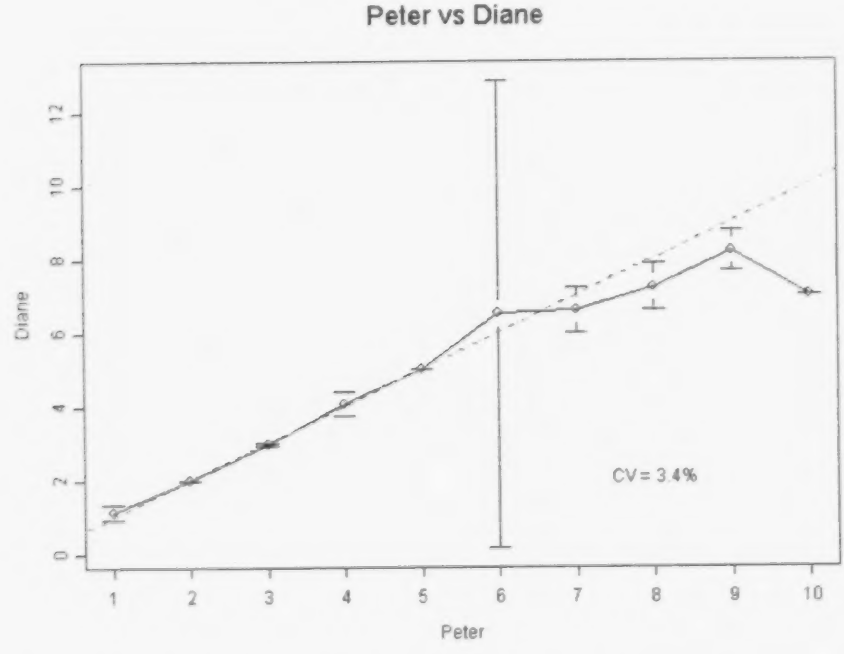



Figure 10. 4X haddock mean number and mean weight per tow from the summer RV survey on the Scotian Shelf (strata 470-481) and Bay of Fundy (strata 482-495).




RV 2000




RV 2001

Figure 11. Comparison of haddock ages by the primary and secondary agers from the summer RV survey in Div. 4X.

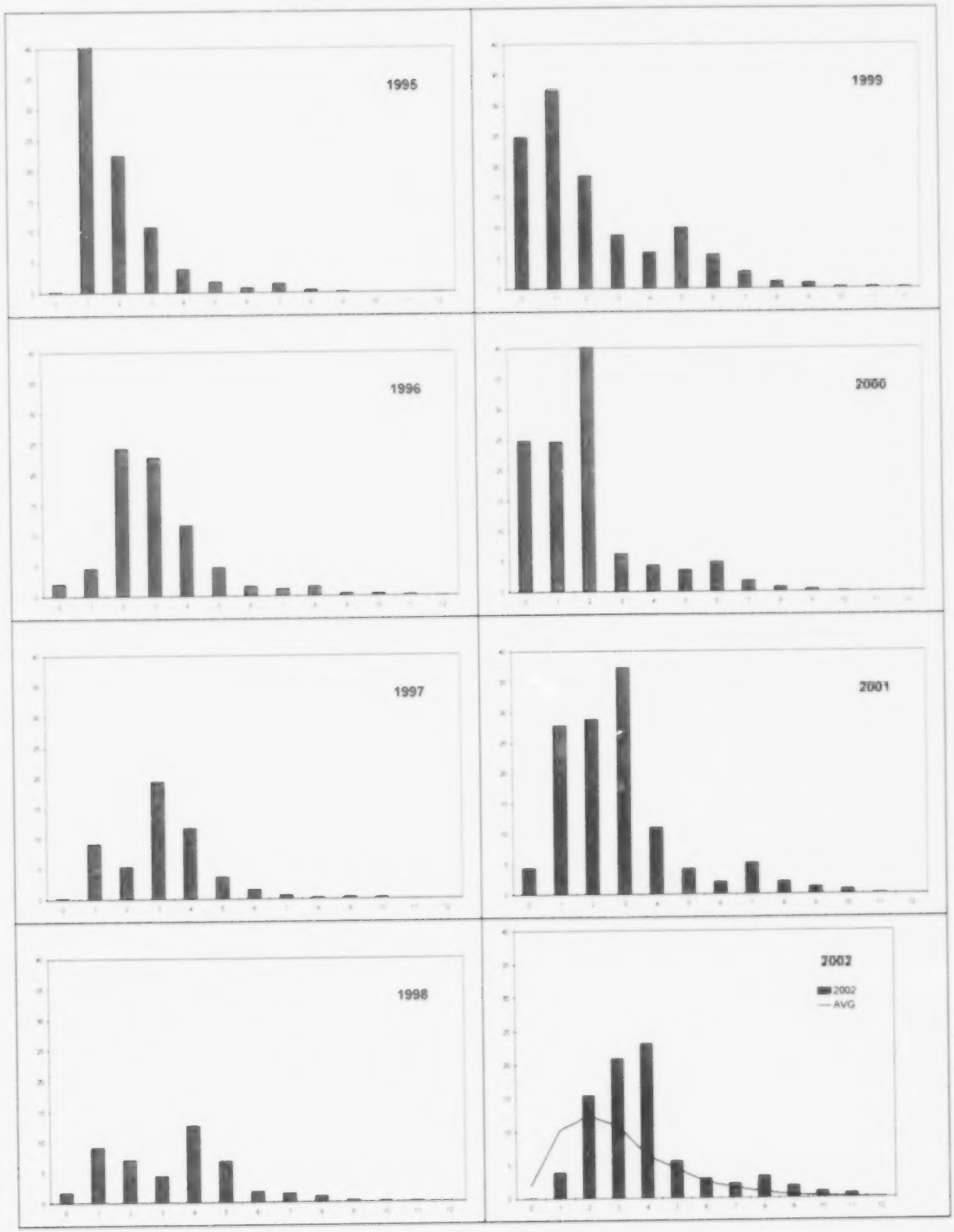
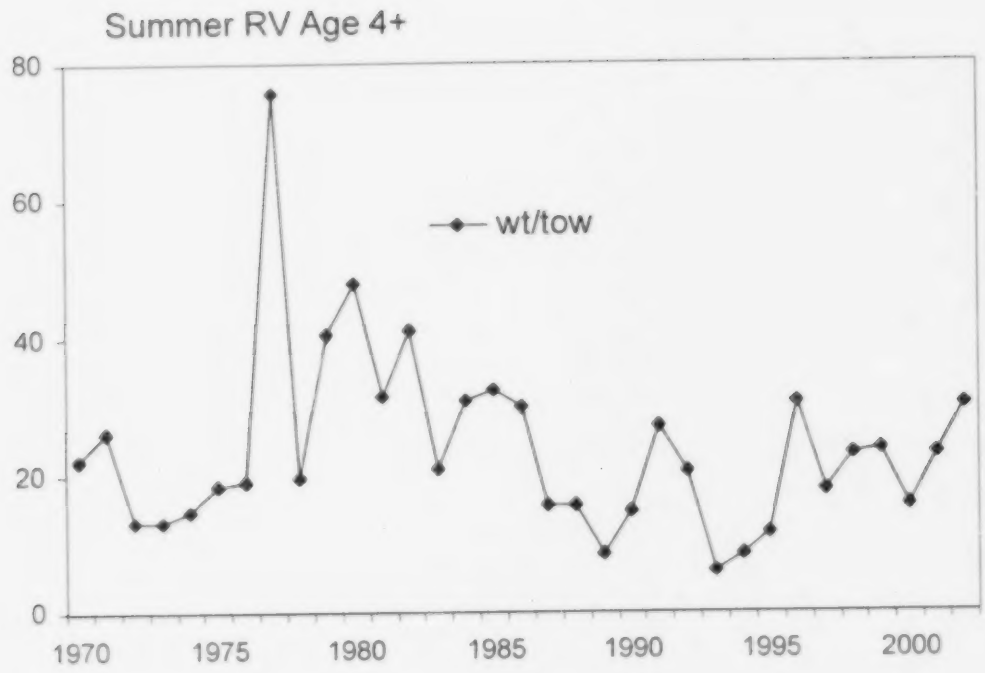



Figure 12. Age composition of 4X haddock in summer RV survey, 1995-2002.



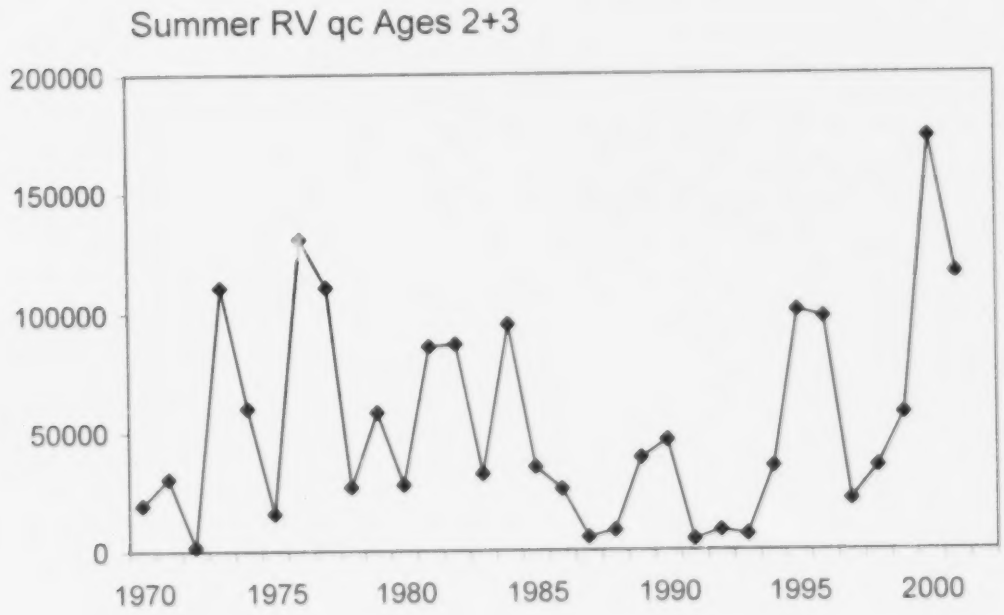
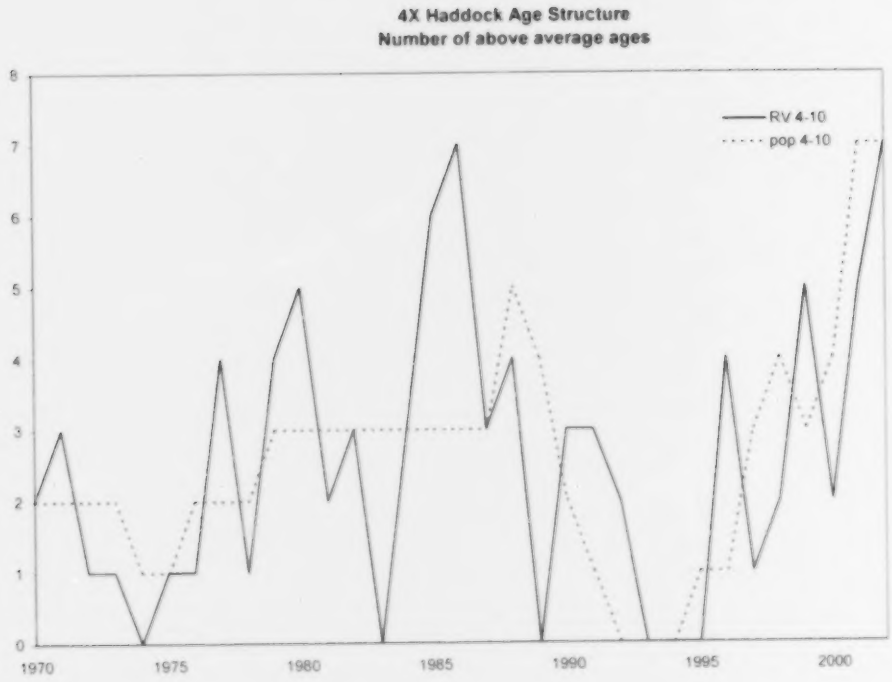




Figure 13. Weight per tow of ages 4+ in the RV survey (upper) and q-adjusted catch per tow of ages 2 and 3.



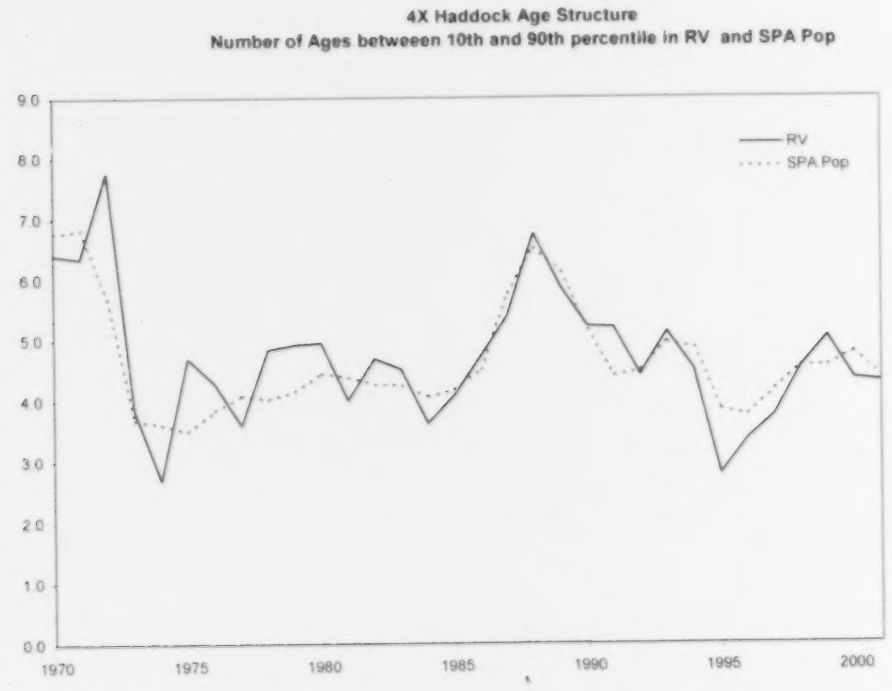
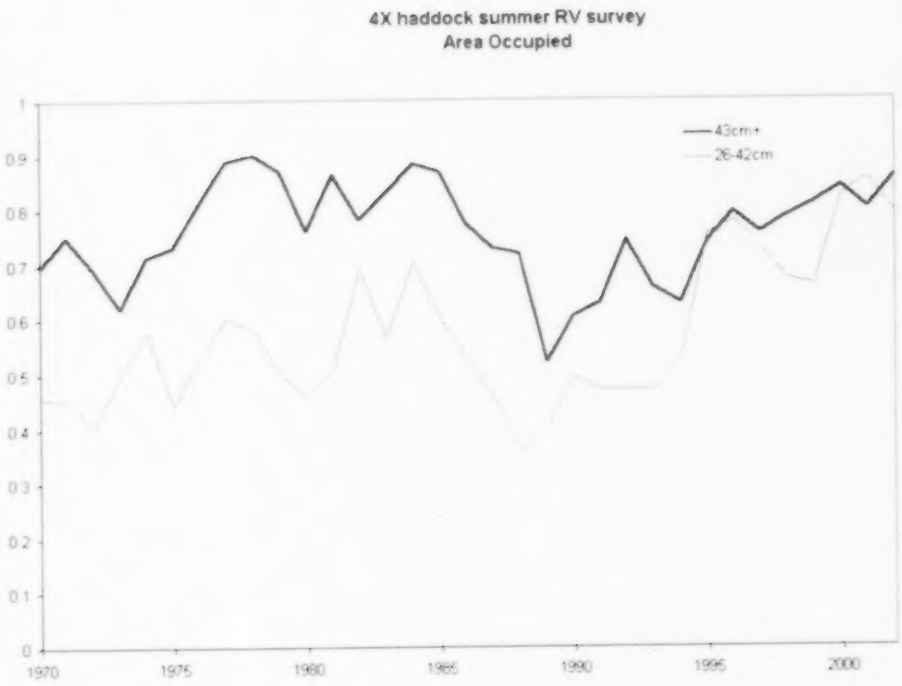




Figure 14. 4X haddock age structure indicators calculated from RV survey and SPA.



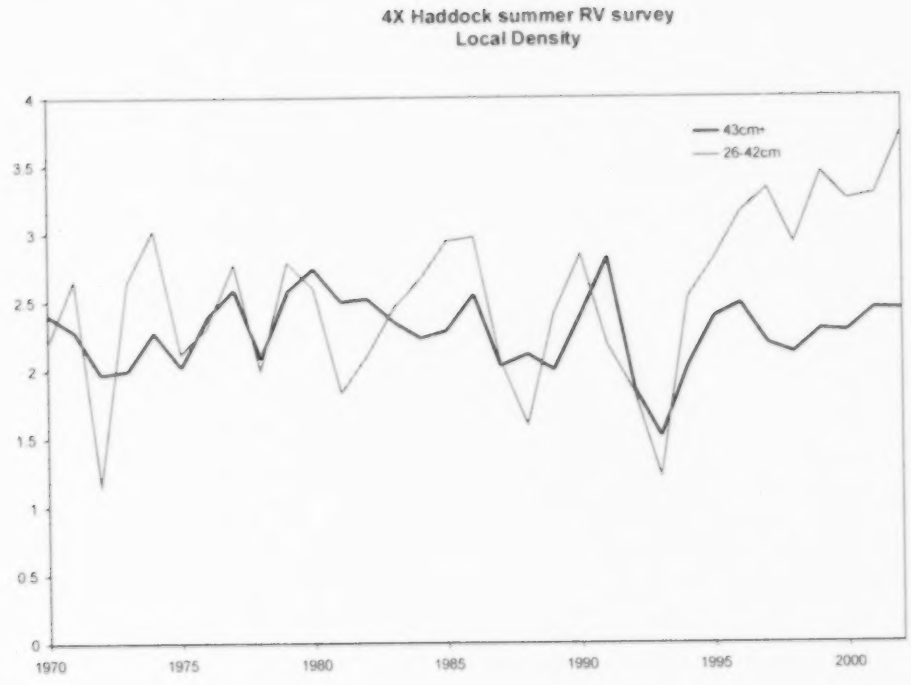




Figure 15. Distribution indices for 4X haddock in the RV survey, 26-42cm and 43cm+.

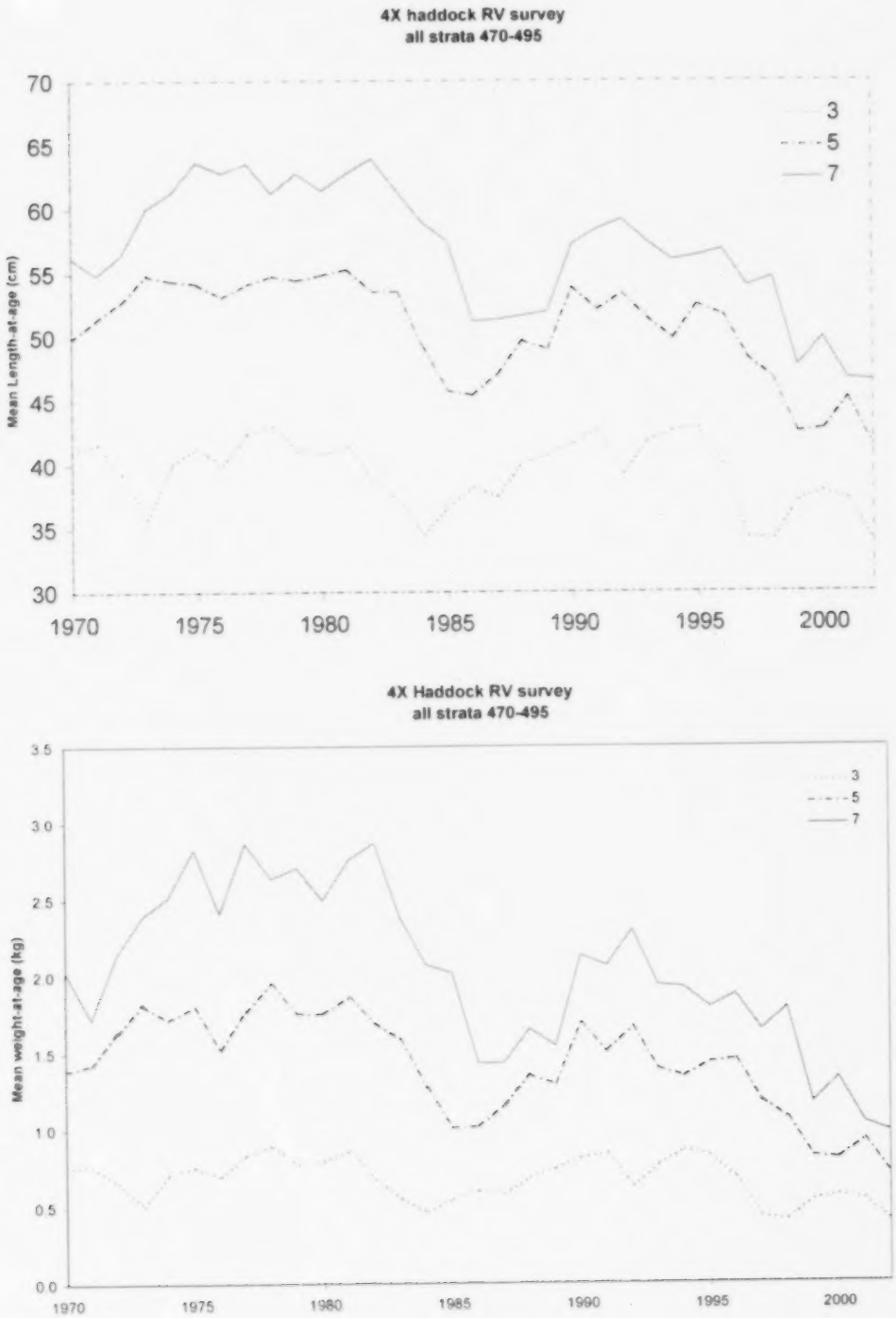



Figure 16. Mean lengtht-at-age (upper) and mean weight-at-age (lower) from the RV survey (all strata 470-495).

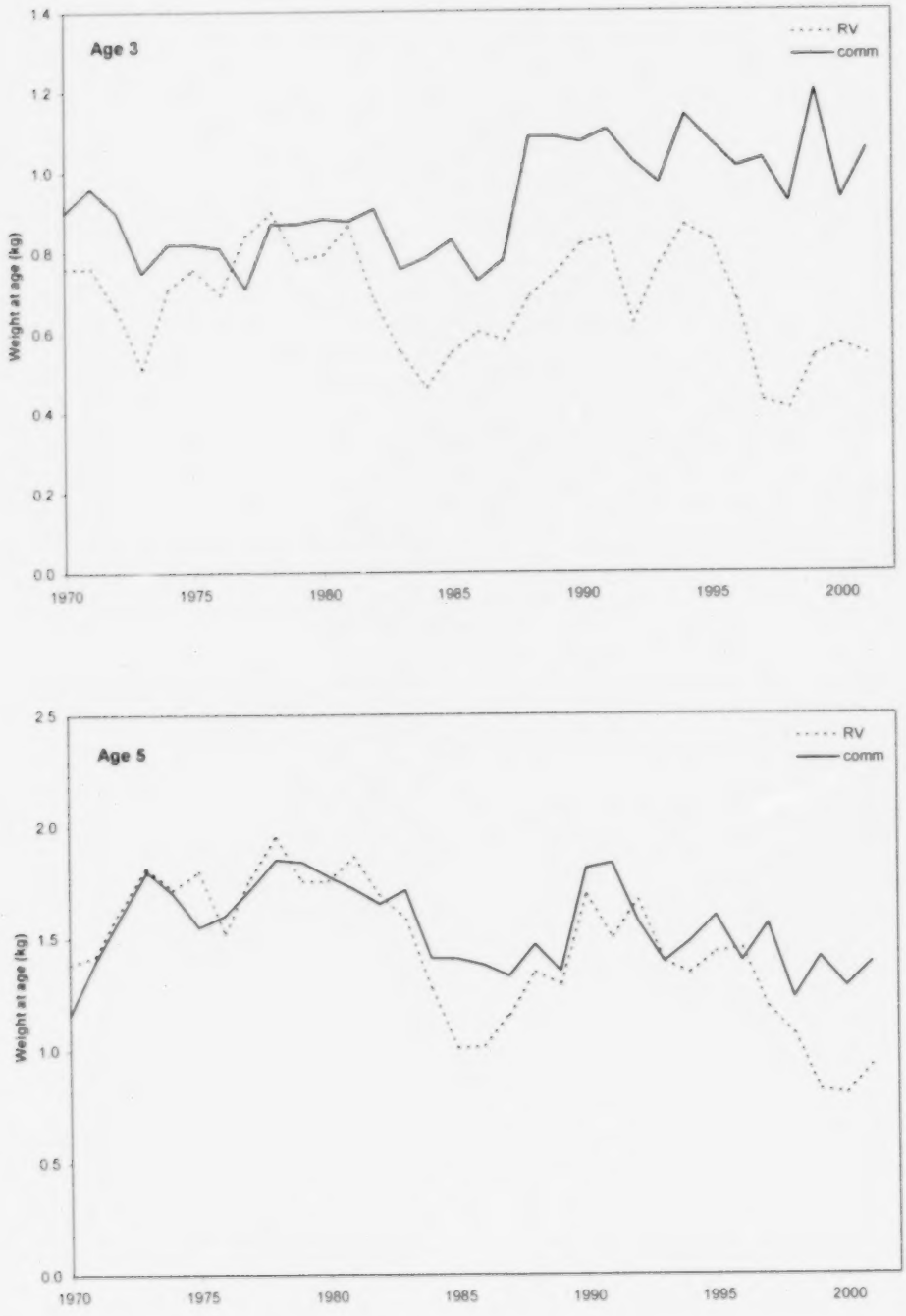



Figure 17a. Comparison of 4X haddock weight-at-age from RV survey and commercial fishery.

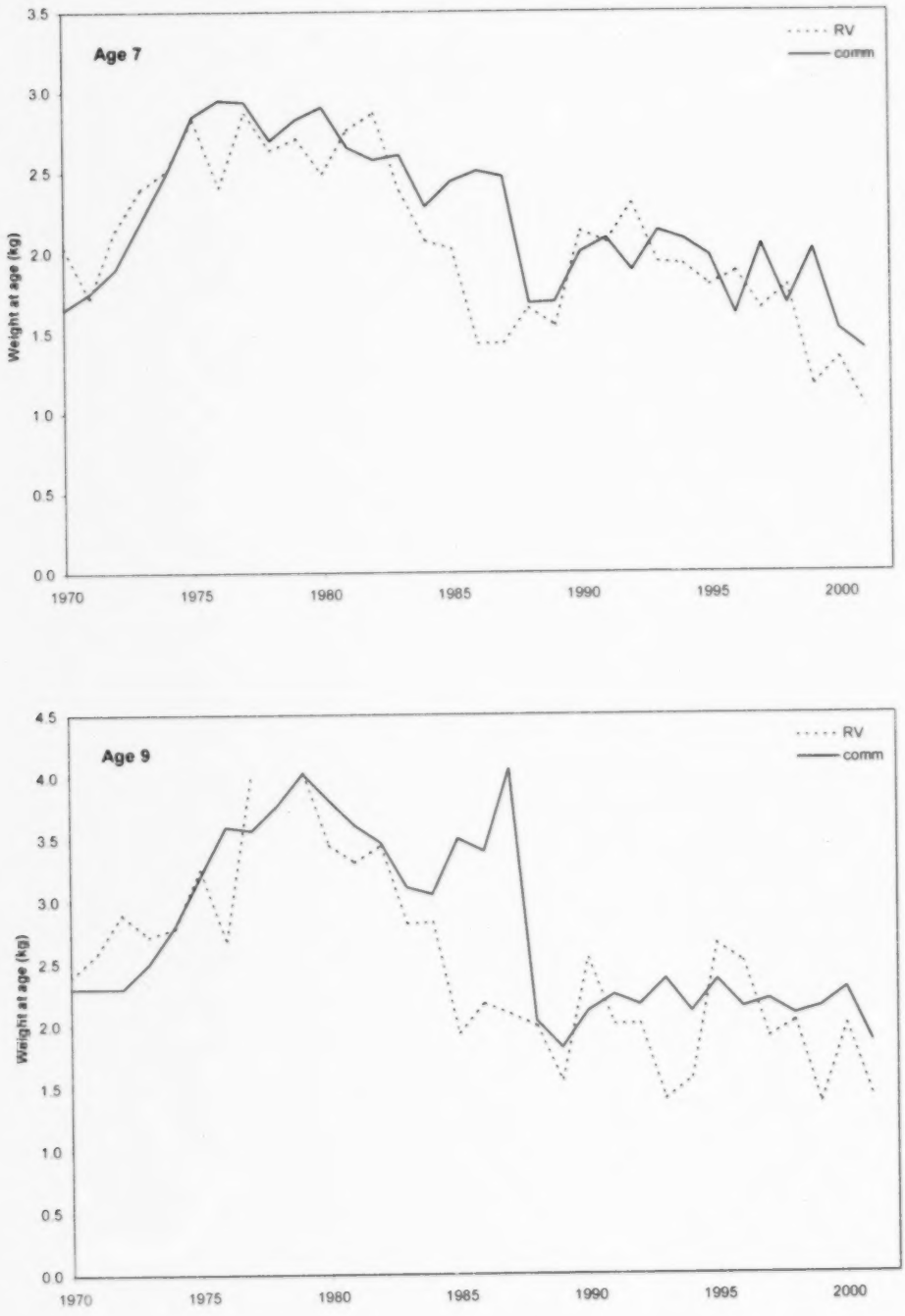



Figure 17b. Comparison of 4X haddock weight-at-age from RV survey and commercial fishery.

Figure 18. 4X haddock instantaneous growth rate (G) calculated using length at ages 2-7 from the RV survey.

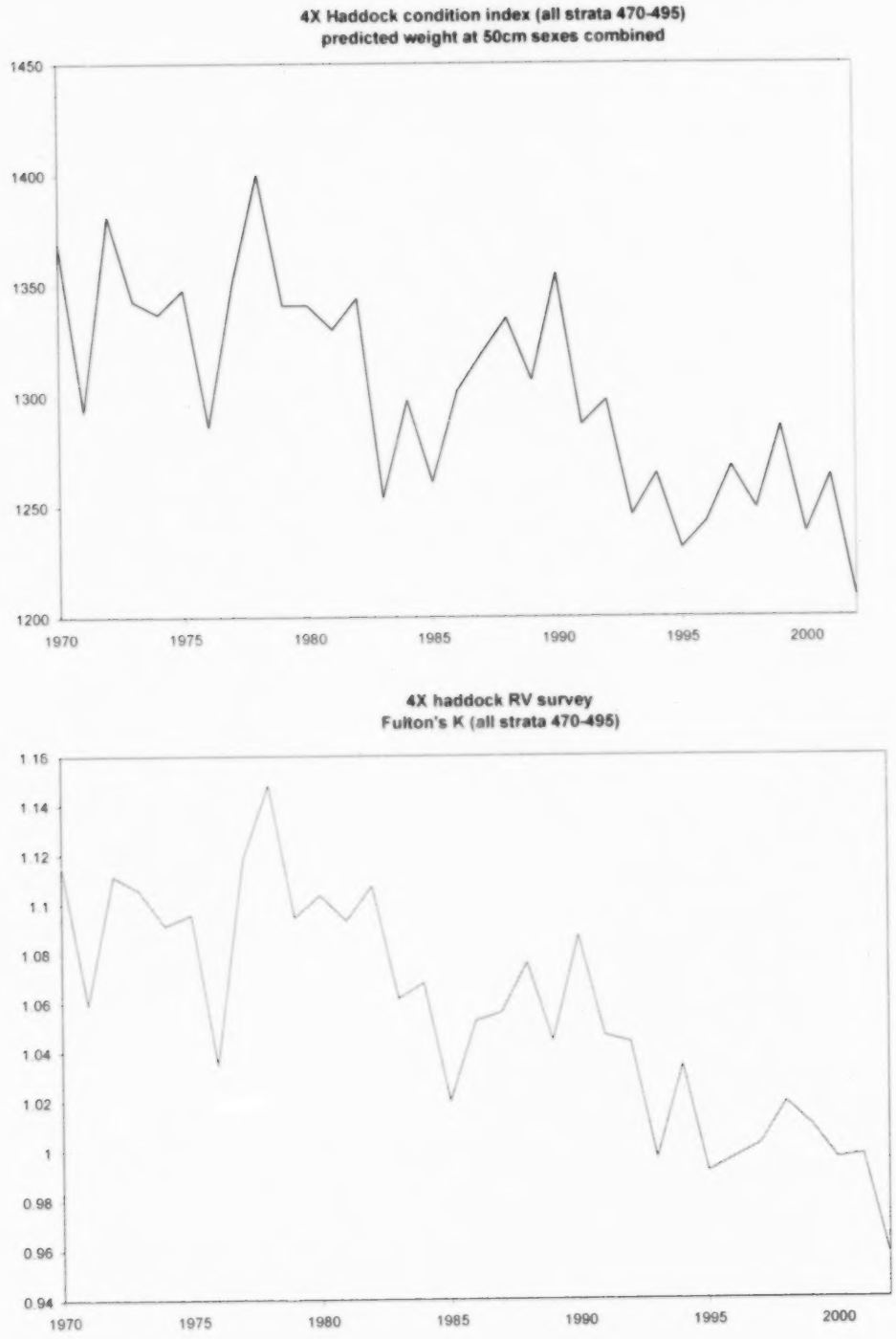



Figure 19. 4X haddock condition indices calculated from the RV survey (all strata 470-495), predicted weight at 50cm (upper) and Fulton's K (lower).

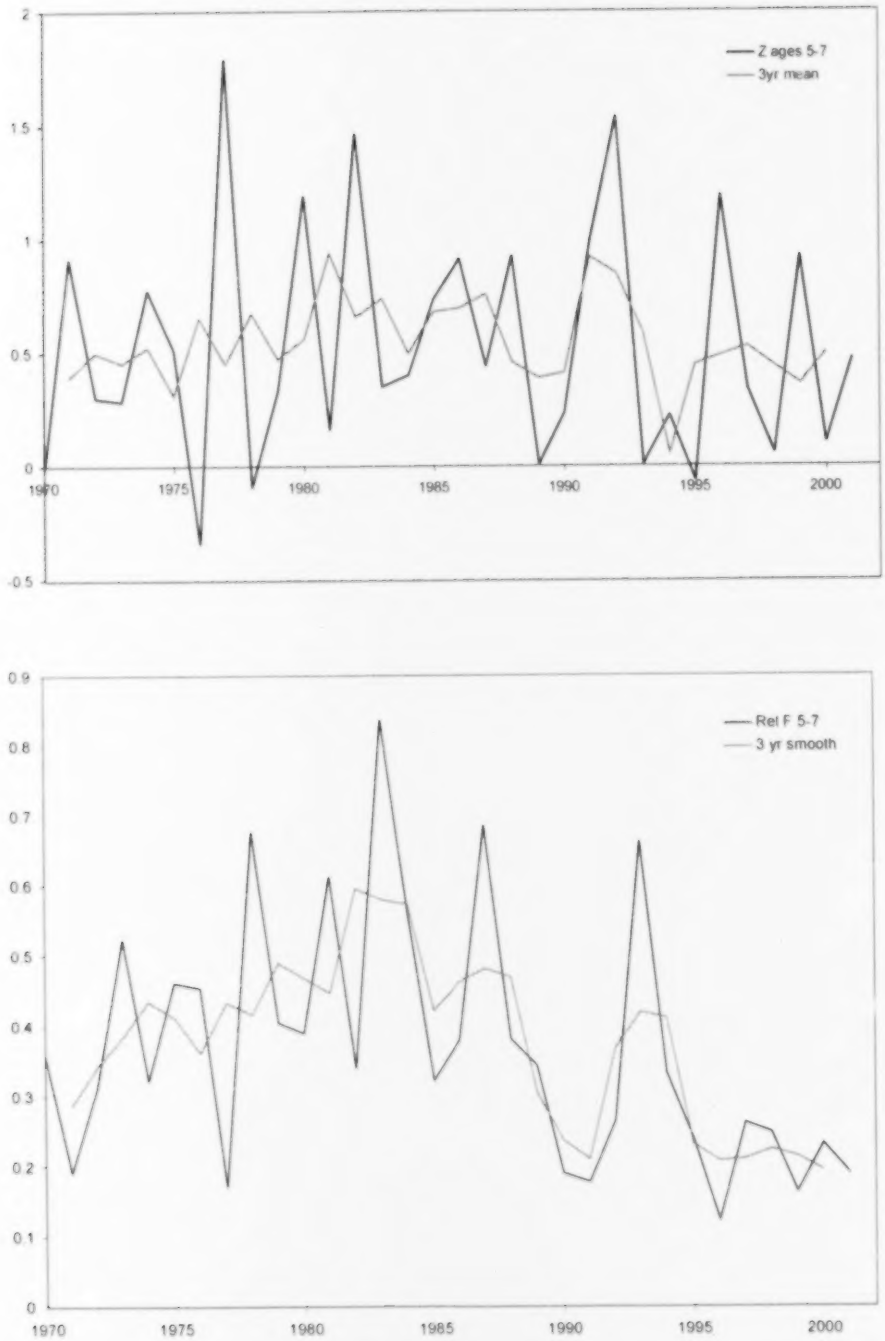



Figure 20. 4X haddock total mortality (Z) estimates ages 5-7 calculated from the RV survey (upper) and relative F ages 5-7 (lower).

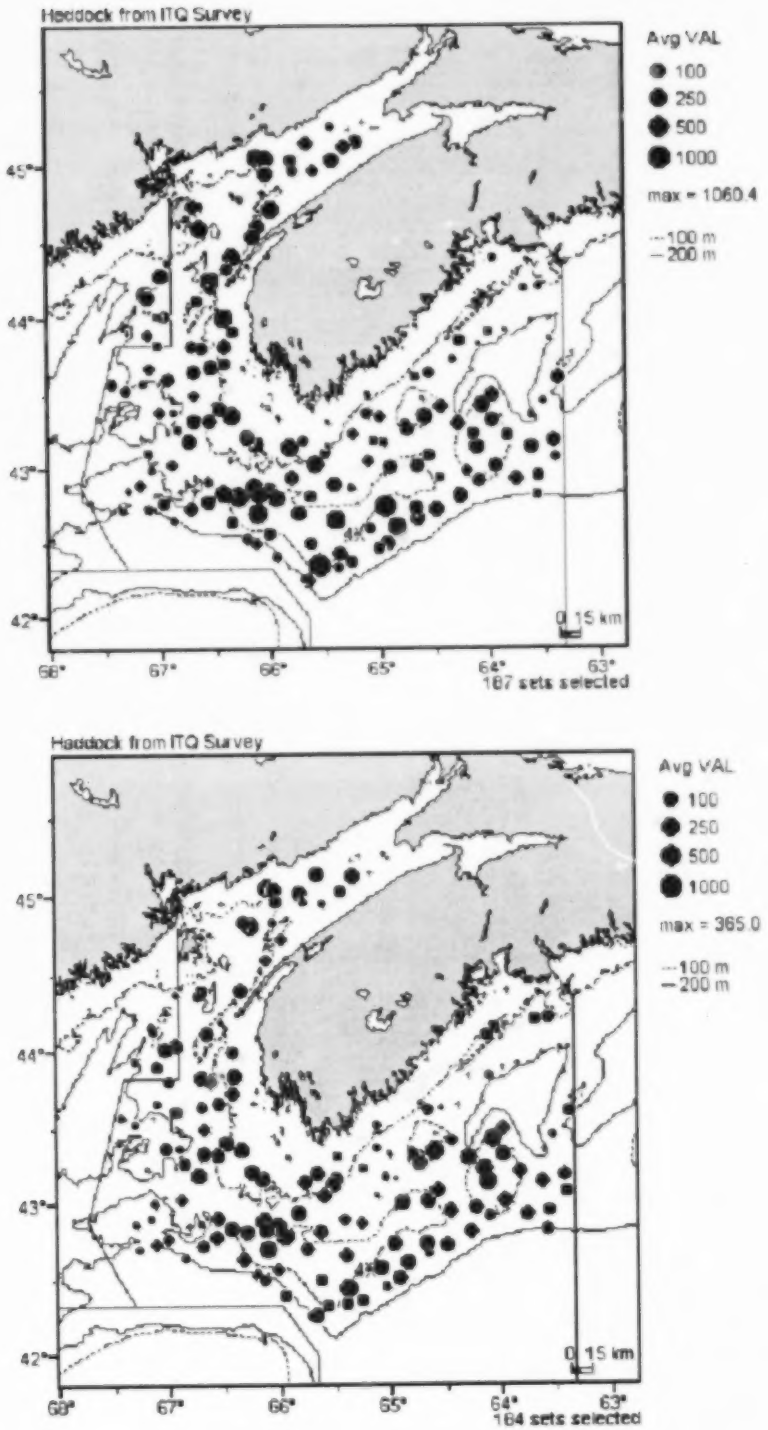



Figure 21. Haddock catches (kg) per standard tow from the 2001 and 2002 ITQ survey.

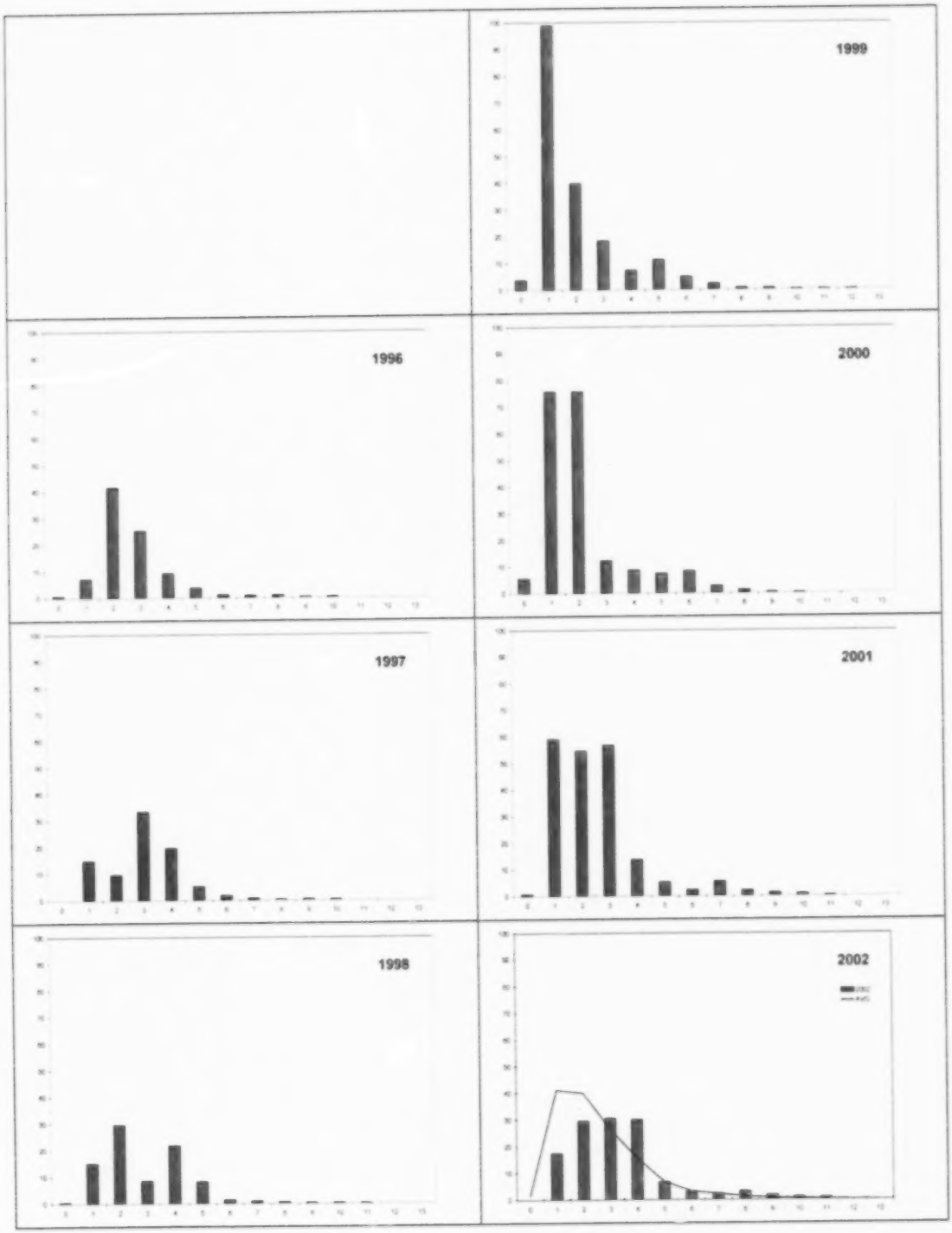
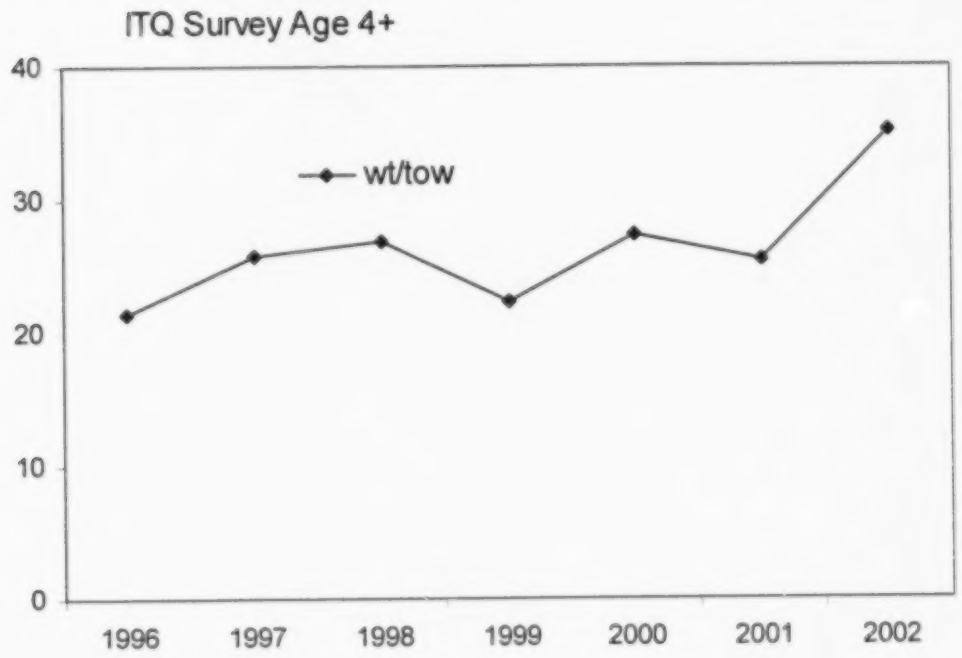



Figure 22. 4X haddock age composition from ITQ survey, 1996-2002.



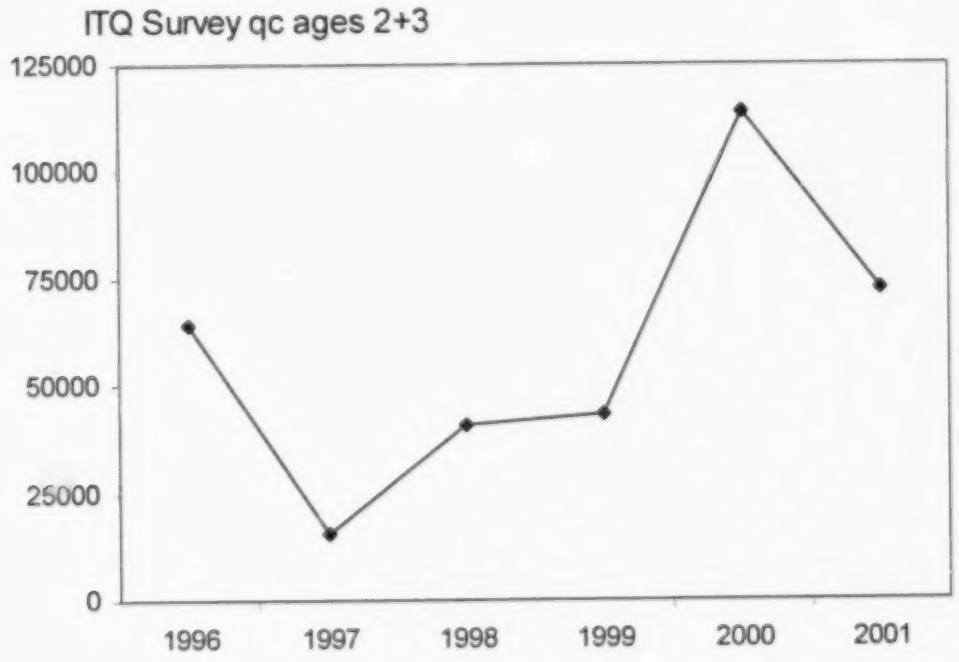




Figure 23. Weight per tow of ages 4+ in the ITQ survey (upper) and q-adjusted catch per tow of ages 2 and 3.

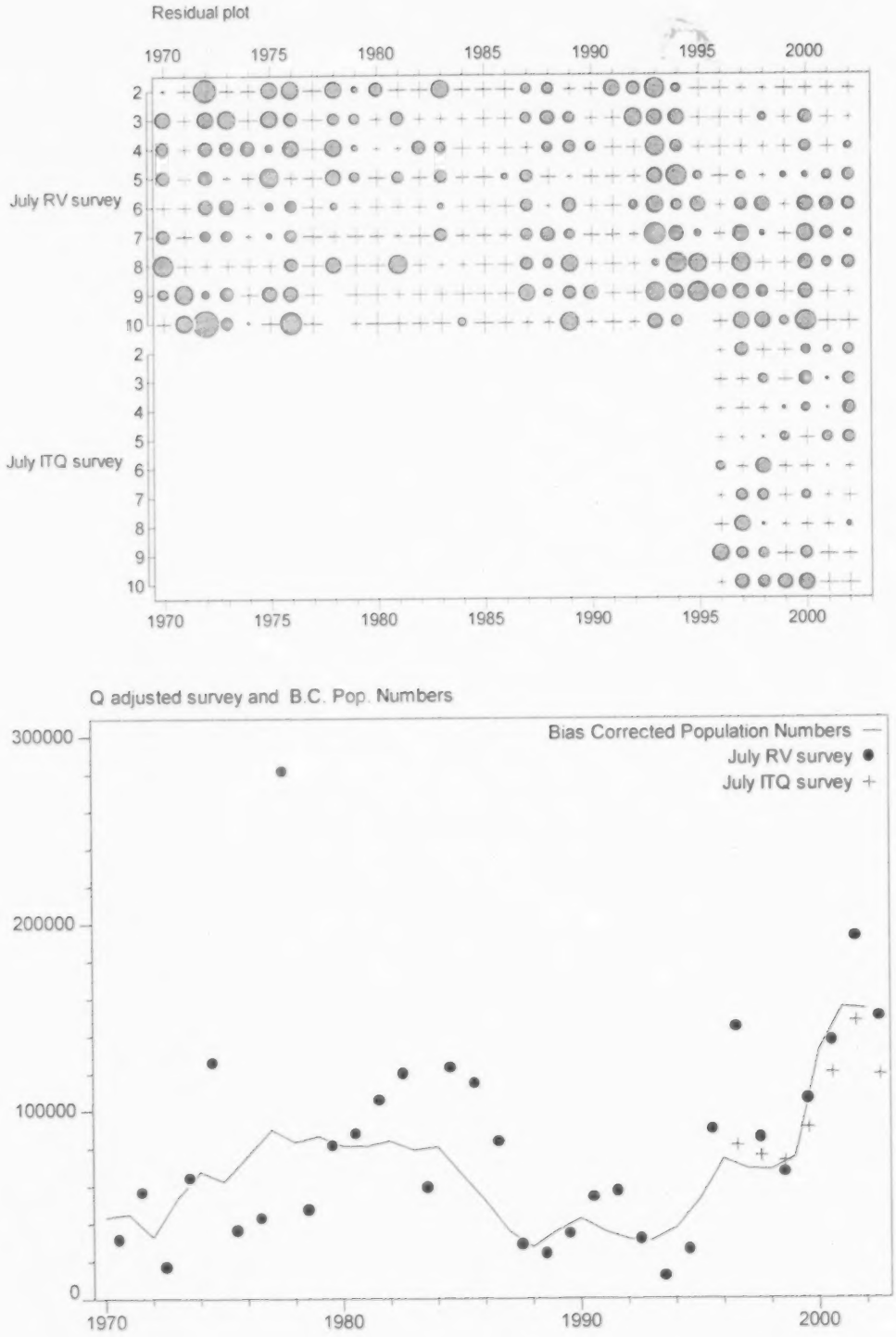



Figure 24. Residuals at age (upper) and population numbers (2-10) estimated from the model and the q-adjusted survey indices (lower).

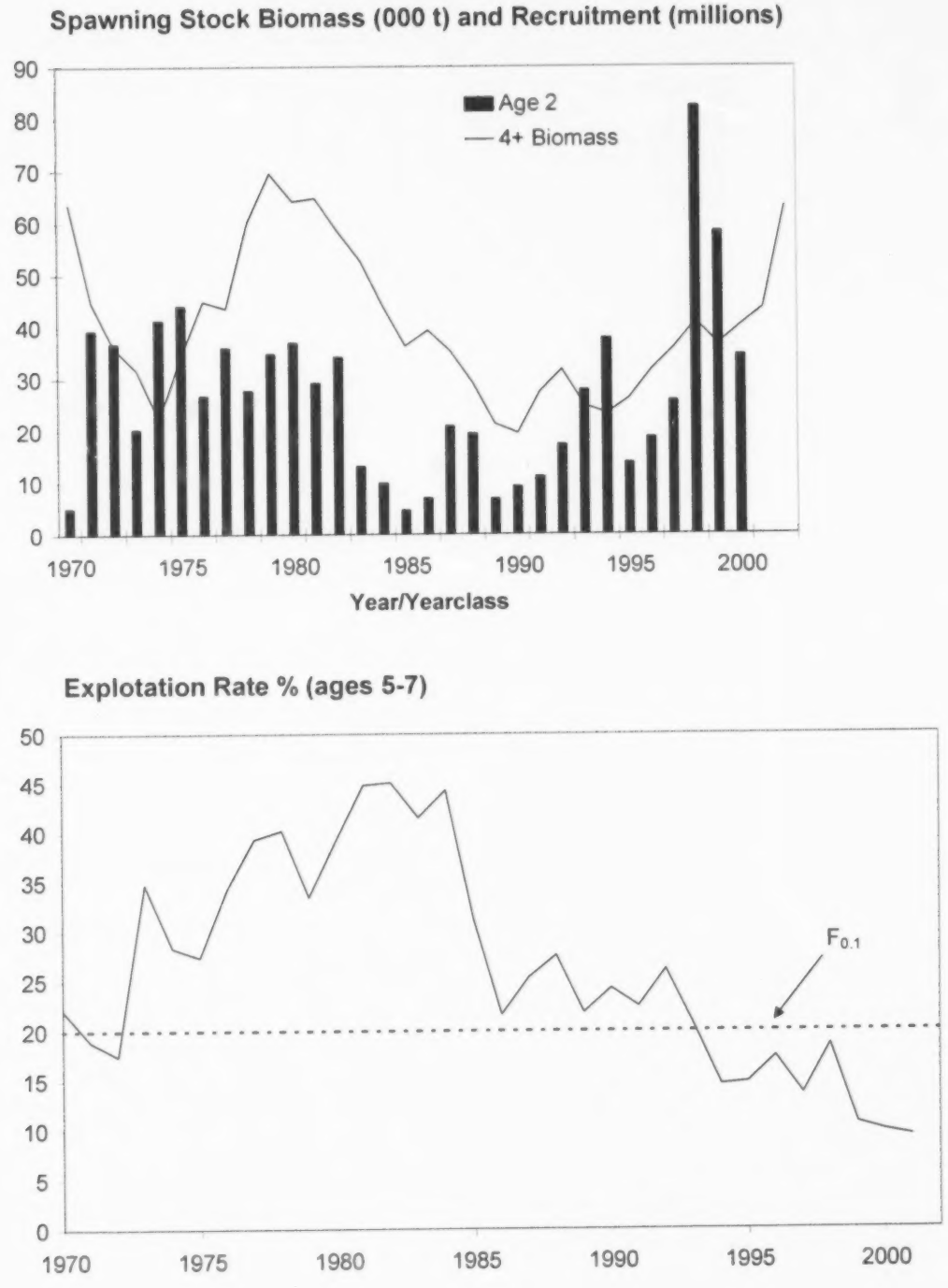



Figure 25. Spawning stock biomass and age 1 recruitment in the subsequent year from the SPA.

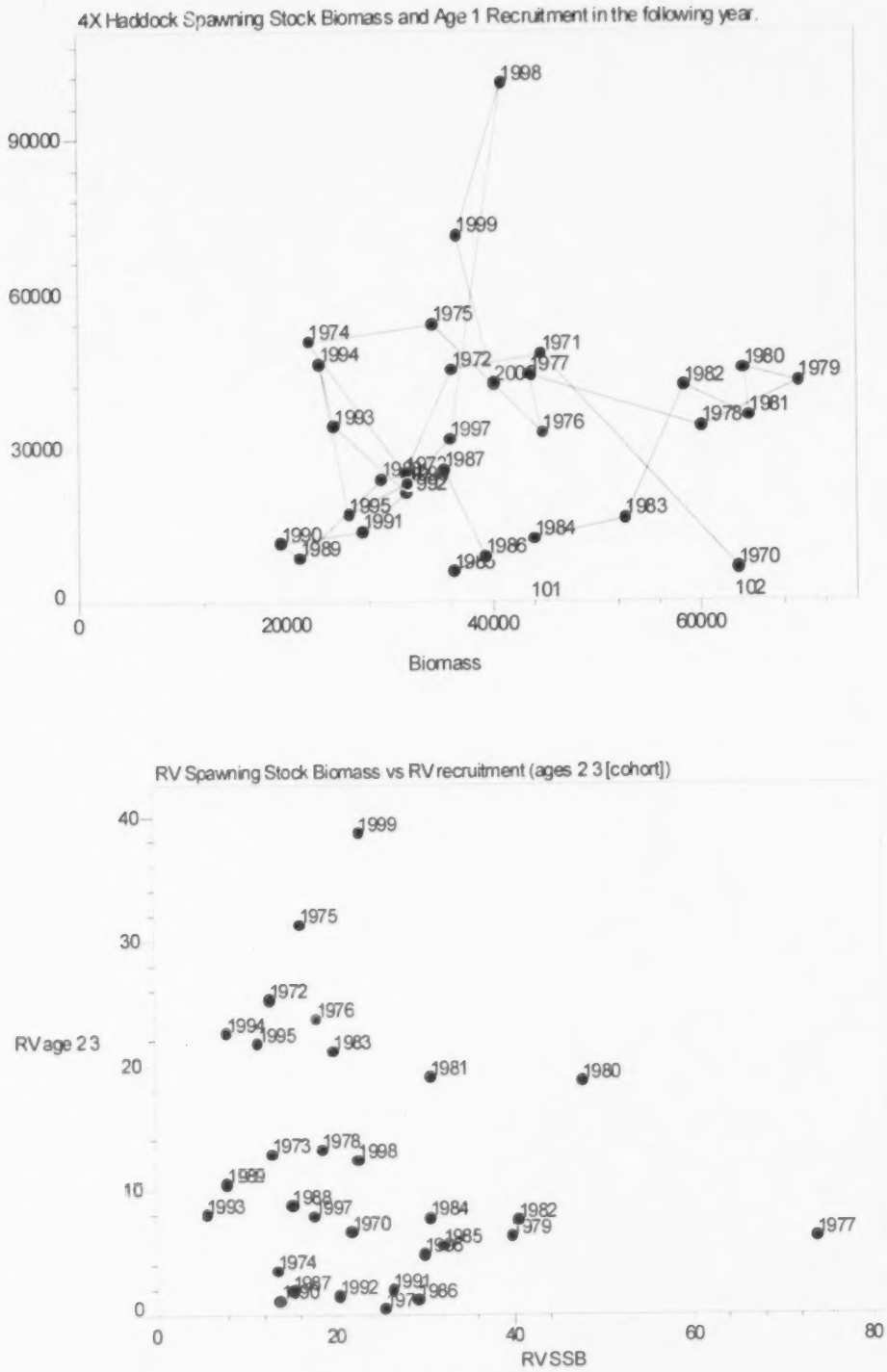



Figure 26. Spawning stock biomass and age 1 recruitment in the subsequent year from the SPA (upper) and RV survey age 4+ and RV survey ages 2+3. Labels are yearclass.

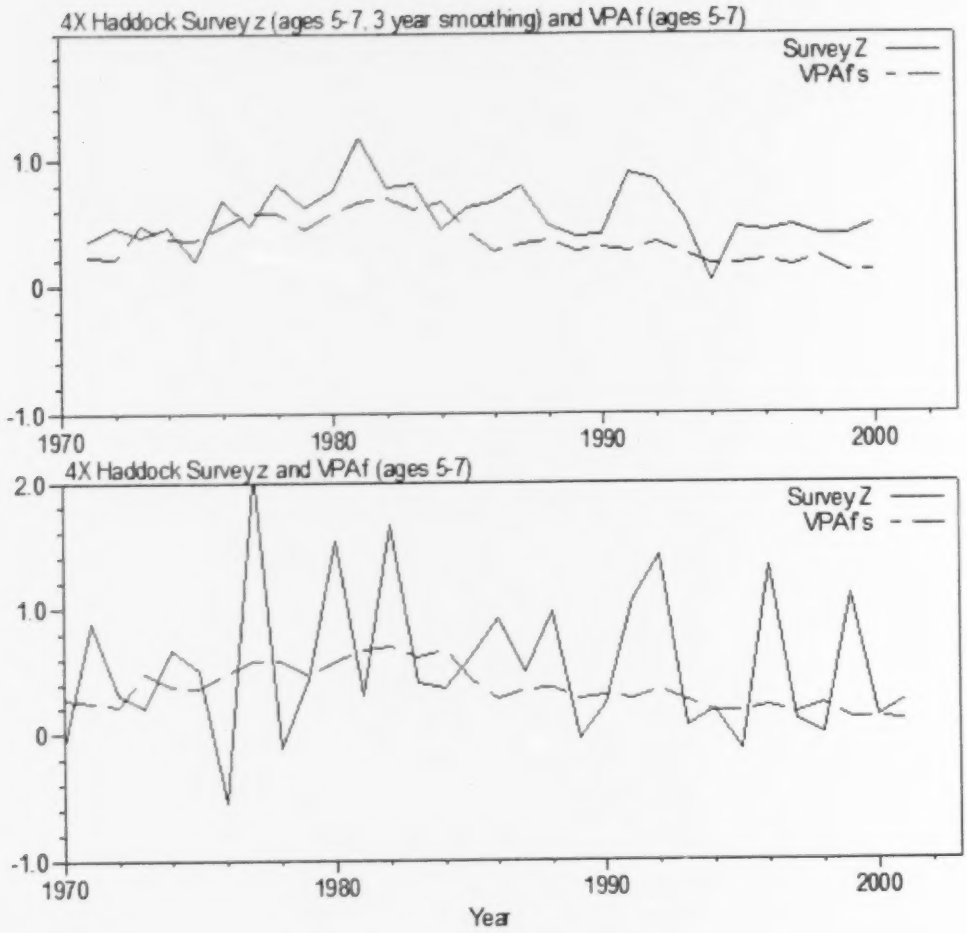



Figure 27. Comparison of total mortalities (Z) calculated from the RV survey and fishing mortalities (F) from the SPA for ages 5-7. Three year running means of RV Zs in the upper panel.

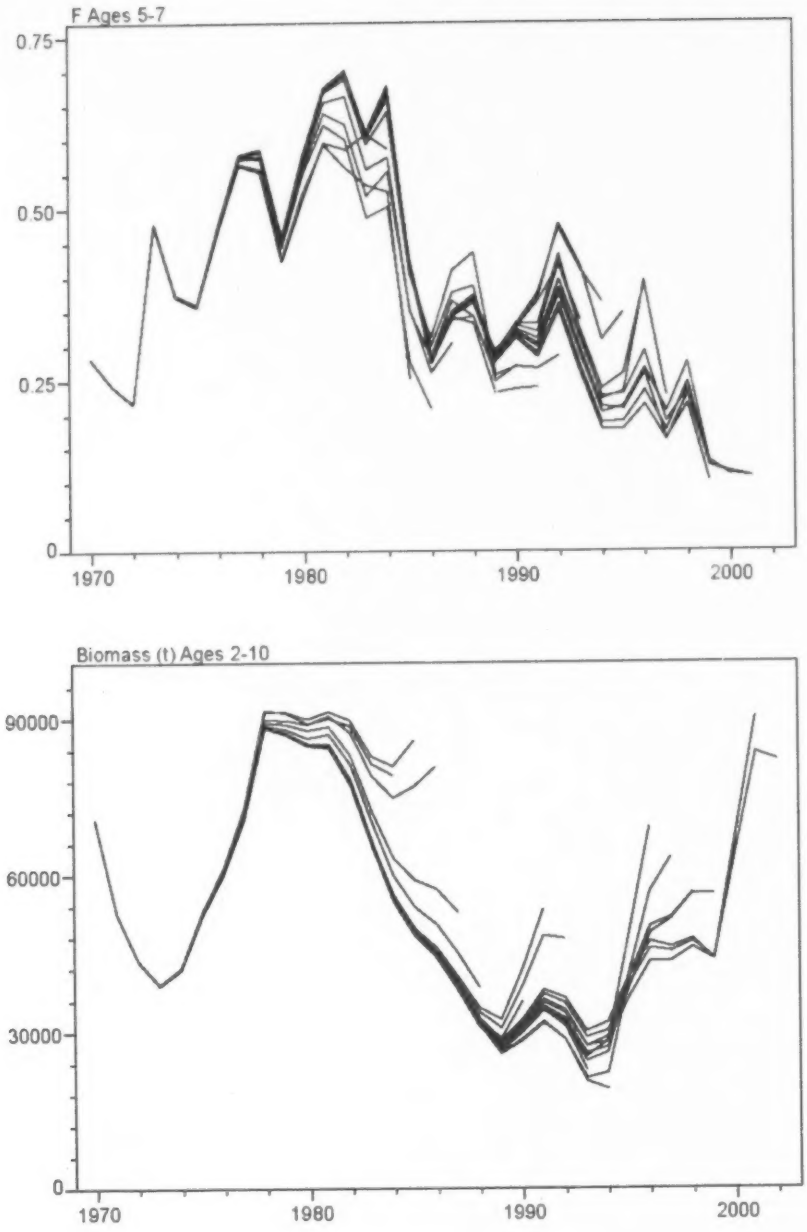



Figure 28. Retrospective pattern.

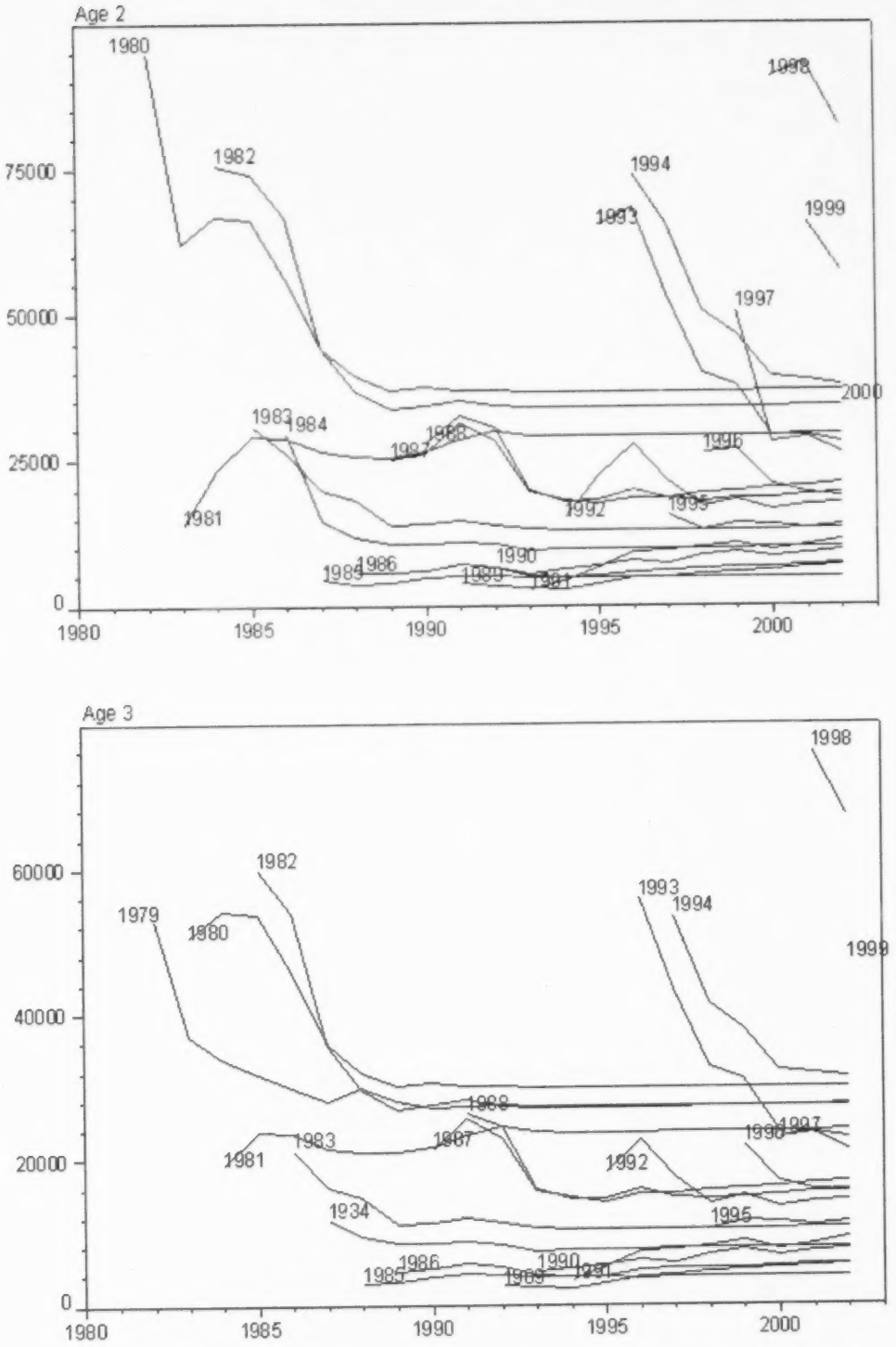



Figure 29a. Retrospective estimates of yearclass size at ages 2 and 3.

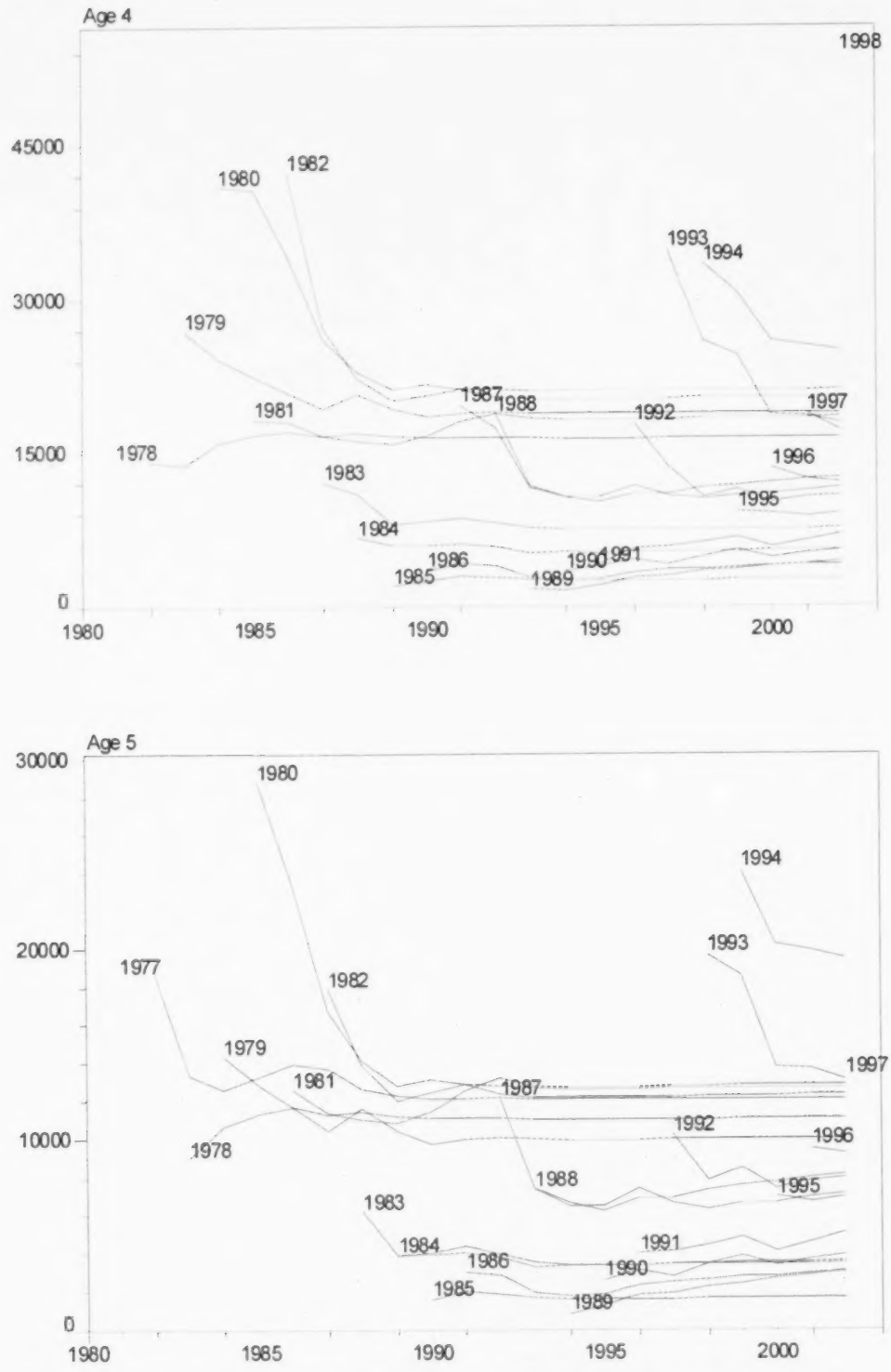



Figure 29b. Retrospective estimates of yearclass size at ages 4 and 5.

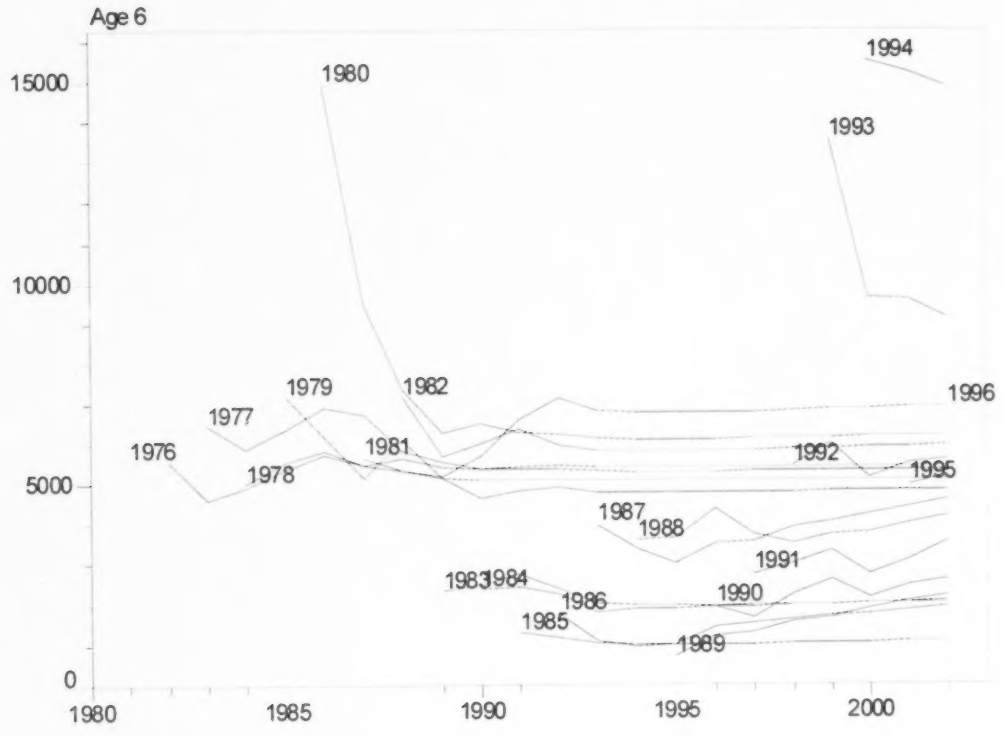



Figure 29c. Retrospective estimates of yearclass size at age6.

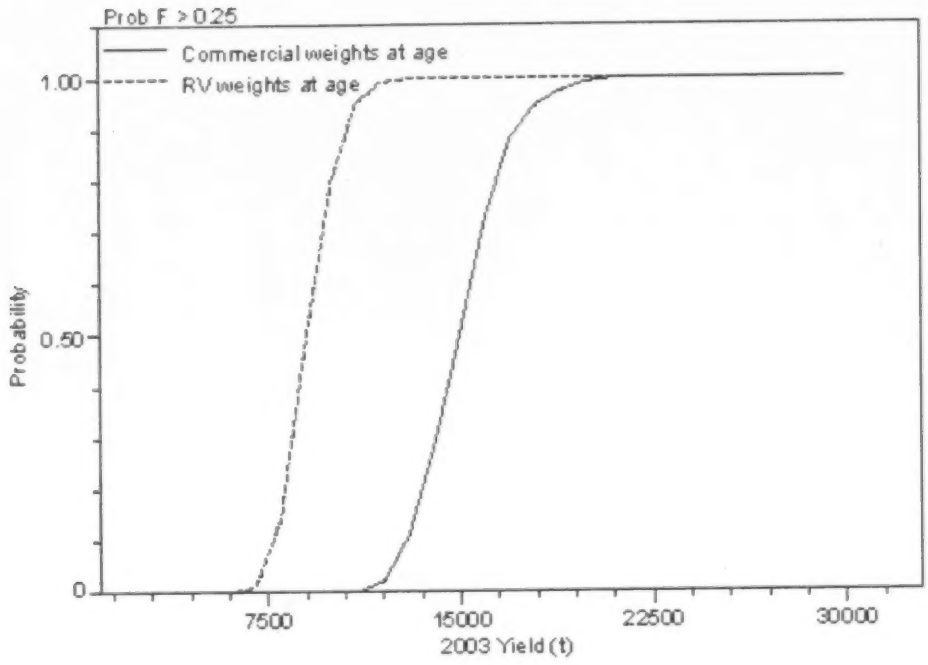



Figure 30. Risk plot – probability that $F_{0.1}$ will be exceeded at various levels of yield, calculated using recent commercial weights-at-age and RV weights-at-age.

Appendix 1. Description of traffic light indicators, boundary points, weights and rationales for 4X/5Y haddock.

The traffic light approach provides a framework that allows us to incorporate multiple indices of stock status and other relevant indicators. Colour boundaries corresponding to good and bad periods can be established qualitatively for some indicators, but remain problematic for others. For most indicators, the history of the index is short relative to the ecological and evolutionary history of the fish populations or of the ecosystems within which they occur. In the absence of quantitative information to specify colour boundaries they have been established by a process of deliberation, where the weight of expert opinion is used to determine the most reasonable estimates. These represent the best available estimates; however all are subject to improvement through ongoing research.

The time period 1970-2002 was used to establish colour boundaries for the 4X/5Y haddock stock status indicators. During this period, abundance of the stock was relatively high during the late 1970s and early 1980s, and relatively low during the late 1980s and early 1990s. Recruitment was relatively good during the mid-1970s through to the early 1980s, but was poor from the mid-1980s to the mid-1990s. Production in terms of growth in the population has decreased throughout the period. Mortality rates were high from the mid-1970s to the mid- to late 1980s. Colour boundaries were set to correspond to these general trends.

| Indicator | Green Boundary | Red Boundary | Characteristic | Weight |
|---|---|---|---|---|
| RV Survey wt per tow ages 4+ (kg) | 31: Consistent with highs observed in late 70s/early 80s | 13: Consistent with lows observed in late 80s/early 90s | Abundance | 1 |
| ITQ Survey wt per tow ages 4+ (kg) | 30: This is a short time series and thus its true range is uncertain. The boundaries were set to be consistent with those for SPA 4+ biomass | 20: This is a short time series and thus its true range is uncertain. The boundaries were set to be consistent with those for SPA 4+ biomass | Abundance | 1 |
| SPA Biomass ages 4+ (t) | 55000: Consistent with highs observed in late 70s/early 80s | 20000: Consistent with lows observed in late 80s/early 90s | Abundance | 1 |
| RV Survey Age Structure –above average ages 4-10 | 5: Consistent with highs observed in late 70s/early 80s | 1: Consistent with lows observed in late 80s/early 90s | Abundance | 1 |
| RV Survey Area Occupied 43+cm | 0.88: Consistent with highs observed in late 70s/early 80s | 0.62: Consistent with lows observed in late 80s/early 90s | Distribution | 1 |
| RV Survey Local Density 43+cm | 2.5: Consistent with highest observed | 2: Consistent with lowest observed | Distribution | 1 |
| RV Survey Area Occupied (26-42cm) | 0.8: Consistent with highest observed | 0.4: Consistent with lowest observed | Distribution | 1 |
| RV Survey Local Density (26-42cm) | 3.2: Consistent with highest observed | 1.6: Consistent with lowest observed | Distribution | 1 |
| RV Survey Recruitment Index ages 2+3 | 87,000: Set to be consistent with those of SPA age 2 recruitment | 18,000: Set to be consistent with those of SPA age 2 recruitment | Recruitment | 1 |
| ITQ Survey Recruitment Index ages 2+3 | 62,000: Set to be consistent with those of SPA age 2 recruitment | 26,000: Set to be consistent with those of SPA age 2 recruitment | Recruitment | 1 |
| SPA Recruitment age 2 | 40,000,000: Consistent with highs observed in late 70s/early 80s | 10,000,000: Consistent with lows observed in late 80s/early 90s | Recruitment | 1 |
| RV Survey Fish Condition (Fulton's K) | 1.02: It is unlikely that K values in the range observed were low enough to have affected reproductive success or mortality, but they do reflect reductions in production | 0.90: It is unlikely that K values in the range observed were low enough to have affected reproductive success or mortality, but they do reflect reductions in production | Production | 1 |
| RV Survey Growth (G) | 0.14: Consistent with highest | 0.07: Consistent with lowest | Production | 1 |

| | | | | |
|---|---|---|---|---|
| ages 2-7 3yr smooth | observed | observed | | |
| RV Survey Total Mortality (Z) ages 5-7 3yr smooth | 0.45: Based on $F_{0.1}$ limit + M (0.2) | 0.70: Twice $F_{0.1}$ limit + M (0.2) | Mortality | 1 |
| Exploitation (%) (ages 5-7) | 20: Moderate F level ($F_{0.1}$) | 36: Twice $F_{0.1}$ limit | Mortality | 1 |
| Relative Fishing Mortality (Ages 5-7) 3yr smooth | 0.25: $F_{0.1}$ limit | 0.50: Twice $F_{0.1}$ limit | Mortality | 1 |